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MODERNIZING CHEMICAL MAN POWER

RUSSIA, whether we like it or not, is going to become a highly industrialized nation. She has already made tremendous strides in opening up vast natural resources and building plants, often equipped with the most modern machinery available. But her real progress has been faltering and disappointing to her leaders primarily because of the difficulty in making over her man power. Five years is all too short a time in which to convert five or six million peasants into efficient industrial workers. This can be accomplished only through the slow processes of education and experience. In the meantime the social experiment continues while the world reserves decision as to its ultimate outcome.

In this country perhaps the nearest approach we ever made to such a national program was at the time of the World War. Wasn't it Mr. Bryan who said that in necessity we could muster a million men to arms from daylight to nightfall? But didn't we learn that it required nearer a year to equip these men with the matériel they needed? In those trying times we also learned that the most important task of all was to pick these men out of private life and train them in the fundamentals of an entirely new job.

But what does all this have to do with chemical engineers in this third year of the Great Depression? We face no such national emergency or communistic decree to make over the United States according to some five-year plan. Perhaps not, but individually and to some extent as a profession, we must now face problems of reconstruction that are to have a determining influence on our future. There is a fight ahead for business and jobs that will require an entirely different sort of equipment and training. There is growing competition from an army of new recruits, schooled under a new regime in our colleges and universities. And there are hundreds of good men among the unemployed, who have profitably used their idle time to sharpen their wits and improve their mental equipment for the impending battle.

We have been talking a good deal about the need for modernizing our plants and processes in order to prepare for a new and more competitive struggle. But have we given any thought at all to the need for modernizing man power? Have we applied to ourselves the same intensive checking up of capacity and performance with which we have measured our processes and machinery? If not, perhaps it is time to begin taking stock and to lay out a program of mental expansion and development.

A modest investment in the study of recent advances in the theory of our science or its application is bound to yield a fair return. A little more intensive cultivation of the technical societies and professional groups in the chemical engineering field would be worthwhile. So would wider reading, particularly some excursions into economics and business administration. Modernization after all is primarily an attitude of mind—a positive willingness to accept the new and discard the old before it becomes an encumbrance to further progress. Let's make sure that chemical man power is awake to all of the opportunities for its own modernization.

EDITORIALS

Reconstruction Continues Despite Political Change

ANOTHER element of uncertainty, real or imagined, has been removed from the path of business recovery. One less alibi is at hand for those who have lacked the courage or conviction to go ahead. The most decisive election in history has put a definite responsibility on the government to work out quickly and harmoniously the most effective solutions for our national problems. In the meantime industry, too, has a responsibility to continue the measures of reconstruction and rehabilitation that have been initiated during the past few months. The program was non-partisan in its purpose and leadership. To fail to support it now is to admit defeat for months to come. But to get behind it and aggressively fight for plant modernization and work sharing will mean better business and more jobs at a time when both are sorely needed.

Learn the Law Before You Act

INDUSTRIAL executives in increasing numbers are rushing to Washington for administrative action on various subjects. Just lately there has been a flood of applications for relief from the competition imposed by the dumping of foreign goods on the United States market at ruinous price levels.

Many appeals have been addressed to the Treasury Department seeking to have imported goods embargoed or taxed because of convict or indentured labor, because of violation of the anti-dumping law, or on other grounds. Some of these appeals have been sound and apparently are going to establish the protective measures intended by Congress in the tariff law. Other appeals, perhaps equally meritorious in fact, were pre-doomed to failure because those making them did not know the law or the procedure involved. One great industrial group apparently thought that if goods were sold in the United States below the cost of production in this country, that alone sufficed to prove "dumping." The law is quite different than this; and the appellants for this industry made themselves appear foolish by taking their ill-advised stand.

Dumping of foreign goods is proved by establishing two things. First it must be shown that the imported goods are being sold in the United States below the prices charged in the country of origin. Secondly it must be proved that the consequence is a significant damage to American industry. Whether the price charged for the imported goods is above or below United States cost or previously prevailing United States price has nothing to do with the matter. And furthermore, a mere claim indicating an honest conviction as to the facts is not enough. A real proof must be established either by the appellant or by investigators representing the Treasury Department. Usually an investigation by the official departmental staff is essential.

In all of these matters there is one outstanding lesson for industrial executives. They should have accurate up-to-the-minute advice regarding law and procedure before they waste their effort or the funds paid to representatives to start such cases before the government departments. Many technicalities are involved and they must be complied with whether one likes it or not.

Losing Tactics for Depression Fighters

IF DEPRESSION is in some ways good for the soul, and if the economy it enforces is good for the liver, it does not follow that spurious economy, nor twice as much economy, will put the patient back on his feet. Doubling the dose of most nostrums is much more likely to complete the job in a way the ailment alone could not do.

The economy wave, as it is now practiced, is a natural outgrowth of its earlier history. So far as industrial buying, at least, is concerned, there seem to have been three epochs in the depression: at the onset, a time of frozen purse strings followed by a second period of slight thaw during which the ruling factor was price and price alone. The final phase, in the current vernacular, is one of chiseling, when buyers chisel prices to even more unprofitable levels while sellers, competing frantically for this sorry business, stoop to substitution, cheapening of product and even to outright misrepresentation.

One recent manifestation of the present mode is a species of self-delusion founded on the immediate economy of substitution. Take the case of the chemical manufacturer who bought a number of ordinary centrifugal pumps for corrosive service where he should have used pumps especially adapted for the special requirements. His engineers specified the cheaper pumps, knowing that the long-run cost would be much greater than that of the more expensive equipment, but they needed pumps and they needed arguments of lower cost and somewhat higher pumping efficiency to force approval from an over-zealous management. They justified the purchase by explaining that, since maintenance charges would be lumped, nobody would be the wiser.

Where the blame should be placed in such a case is obvious. Although the pump manufacturer may not have known the service for which the pumps were intended, it is more probable that he made the sale in the full knowledge that they could not stand up and that eventually they would work to his discredit. The engineers weighed the evils of no pumps versus poor pumps and chose the latter in the belief that their poor judgment could not come home to roost. The manufacturer, in establishing his economy program, put a premium on substitution and poor judgment. It is evident that the onus touched every party to the transaction but rested chiefly on the management's definition of economy.

The cure, it seems to us, is for everyone, buyer and seller alike, to strive for the longer point of view. Reasonable economy may be both desirable and impera-

tive, but at the same time, economy that has as its foundations cheapening, false efficiency and unwarranted substitution should be ferreted out and exposed for what it is. This is no more the task of the buyer than it is of the seller for the policy of *caveat emptor* has long been recognized as a most unprofitable way of doing business.

What of This Index Of Prosperity?

ALMOST every speaker or writer on chemistry in general, or on sulphuric acid in particular, prefaces his remarks with the statement that the quantity of sulphuric acid consumed by any country is a measure of its civilization. But it is only occasionally that the name of the author of the original statement: Justus von Liebig, is mentioned. In his "Letters on Chemistry," first published in 1844, is the following: " . . . you will perceive that it is no exaggeration to say, we may judge, with great accuracy, of the commercial prosperity of a country from the amount of sulphuric acid it consumes.

This is the sort of statement we should expect from that testy, cautious scientist who is reputed to be the father of both modern agriculture and technical education. Note that he says *commercial prosperity* and not *civilization*. Acid makers can testify that, whatever the state of our civilization, our commercial prosperity and the consumption of sulphuric acid are indeed proportional.

Nevertheless, there are scientists today who have proposed other indices. One steel maker claims to measure prosperity by the consumption of steel, since it enters into almost every modern necessity and convenience. Another steel man would narrow this index by making it the amount of steel scrap we produce. The steel for bridges, buildings, ships and machinery that is thrown away for bigger and better structures and equipment is the true measure of our progress, according to this philosophy. That much machinery is worked to the limit of its endurance, and scrapped the instant better is available, does demonstrate a connection between the scrapping of steel and prosperity.

A distinguished metallurgist, Dr. Saklatwalla, once proposed still another criterion: prosperity is proportional to the quantity of a nation's steel production that is heat treated. The heat treatment of steel necessitates vast plant investment and is a sound method of conserving our dwindling iron resources. Without heat-treated steels, modern motor cars, locomotives, steamships and superspan bridges would be impossible of achievement. Assuredly, the steel men have made out a strong case in trying to deprive chemistry of the traditional index.

However, when we reflect that agriculture, chemistry, metallurgy, hygiene, aviation, and power are but a few of the creatures of sulphuric acid, we feel that our index is still safe. No other single entity, save perhaps fire or water, is more essential to our general well-being.

Liebig, himself, once said that all his pronouncements would one day be proven false. Perhaps only this one—that prosperity and the consumption of sulphuric acid are proportional—will stand the test of all time.

Herald the Return of A Friend of the Family

BEER not later than March, with a strong possibility of it before the coming short session of Congress is many weeks old! That is the studied prediction made Nov. 4 by Matthew Woll's committee from the executive council of the American Federation of Labor. The events of Nov. 8 and since have served to strengthen our conviction that the process industries will shortly have an opportunity to welcome back into the fold a prodigal son whose presence has been singularly missed since Jan. 16, 1920.

The imminence of this homecoming stirs up a lot of questions in our mind and apparently in some others, What kind of an industry are we going to have? Who's going to run it? What part will chemists and chemical engineers play in the process? What has become of the 1,100 breweries that thrived in our midst in 1918 and employed some 75,000 men of whom a fair proportion were technically trained? We know that less than 200 breweries are now in legal operation so that a great many have been standing idle or have been converted to other use. How long will it take to recondition and re-equip these? Will they be the same as they were in the old days or will their owners take advantage of more modern machinery and materials of construction?

According to an economic study in the October issue of *The Index*, more than $200,000,000 worth of new equipment will be necessary to put the industry on its feet. The stimulating effect of such an expenditure would be felt by the manufacturers of brewing and distilling apparatus, the makers of refrigerating machinery and cooperage, bottling plants and, of course, the metal, glass and glass-lined steel producers who supply the construction materials.

Perhaps the wish is father to the thought but our own view is that the new brewing industry in this country will be quite different from that of fifteen years ago. In the beginning it may have to carry over some of the old technique and presumably will seek the services of those brew-masters of the old school who are still available. But the new crop of technical men in this industry will undoubtedly consist of chemists, bacteriologists and engineers, who see an opportunity to apply their technology in a new and rapidly developing field.

Quite apart from social and economic aspects, the relegalization of beer and light wines in this country is likely to have an important influence on the chemical profession. It is time that we do what we can to guide that development into proper channels so that the new industry will start from scratch with the best of chemical engineering personnel and equipment behind it.

CHEMICAL PROGRESS IN THE U.S.S.R.

By ALCAN HIRSCH

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Benzol scrubbing towers, Kuznetstroi coke oven plant

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Information on the industrial development of the Soviet Union is generally so conflicting that the careful observer finds an intelligent interpretation difficult or even impossible. Dr. Alcan Hirsch, whose position as consultant to the Soviet Government has afforded him an excellent opportunity of making a first-hand survey of the developments in the chemical field, has briefly outlined the progress made under the present program. His presentation, which the wealth of material necessarily limits to a sketchy outline of the basic data, should be read with interest by the engineer, whose attention is more readily captured by statements of accomplished facts than by dreams and vague unrealities.

THE EDITOR.

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PRE-WAR RUSSIA, with her slow industrial development, had no chemical industry of importance. The country was almost completely dependent upon imports in this field. Matches, rubber goods, medicines, perfumes, and a small tonnage of sulphuric acid were the only chemical products manufactured. War and revolution spelled almost complete disaster to the home industry. This, however, did not prove to be an irreparable loss, as the plants and equipment were obsolete and in bad repair, and as practically no correlation existed among the various units.

In the industrial program of the Soviet Union, the development of the chemical industries has been given a prominent place, with a capital investment of 1,400,000,000 rubles under the first five-year plan—an investment exceeded only by that of the metal and the fuel industries. The manufacture of fertilizers, so important in the agricultural development of the country, was given first attention. An illustration of the progress made under the plan may be given in the production of superphosphate, which in 1932 is expected to reach 850,000 metric tons, placing Russia third among the world's producers. Production of sulphuric acid, in 1931 only about 400,000 tons, is expected to be more than doubled in the current year, the estimate for the year being 830,000 tons, advancing Russia from sixth to third place among the producing nations.

A good example of the results achieved is furnished by the Berezniki-Solikamsk combine, one of the most important in the Soviet Union. It is situated at a latitude of 58 to 60 deg. N., in a region where the mean temperature for the year is close to the freezing point. Here one of the largest potash deposits in the world has been discovered, extending to the banks of the Kama River. About 110 km. (70 miles) to the south are the rich Kizel-Ghubakhsky coal fields, in a district where oil is also found. The Khibini apatite deposits, among the most important in the Union, are estimated to contain 500,000,000 tons of ore. Other phosphate deposits are found a short distance to the west near Chernokholunitsy.

Kama River, a tributary to the Volga, flows through the district; this river is now being dredged for navigation at its upper reaches, and a dam is being constructed.

A canal connecting the Kama and the Pechora rivers will provide an outlet to the Bay of Indigo on the Baerentz Sea, which is free from ice eight months of the year; here a sea port will be built. Another port is planned at the outlet of the Mezen River into Mezen Bay. Solikamsk has railroad connections with Sverdlovsk, and another line is being built from Kizel to Perm.

The potash deposits consist of sylvinite ($NaCl \cdot KCl$) and carnallite ($KCl \cdot MgCl_2$ aq.). The former, which is of high purity, contains no potassium nor magnesium sulphate. Insoluble, mainly iron oxide, silica, lime, and magnesia runs as low as 0.5 per cent, with a maximum value of 6 per cent; KCl content is 28–30 per cent in the sylvinite, 17–18 per cent in the carnallite. Bromine occurs in varying amounts, from 0.01 to 0.15 per cent. Construction of the first potash plant in the U.S.S.R. was begun in 1927, near the city of Solikamsk; in 1931, 150,000 tons was mined. The bulk of the commercial product analyzes 85 per cent KCl, 13 NaCl, 1.5 per cent insoluble, with traces of magnesia and lime. A second mine is being opened about 30 km. from the initial workings, and a treatment plant is being built 4 km. from Solikamsk for production of potash fertilizers, metallic magnesium, and magnesium salts. Estimated production for 1932 is: 175,000 tons of salt with 53 per cent K_2O; 25,000 tons with 62 per cent K_2O; and 100,000 tons with 15 per cent K_2O.

In addition the Berezniki group includes plants for production of sulphuric acid and superphosphate; a synthetic ammonia plant of 90 tons daily capacity, erected and put into operation by the Chemical Engineering Corp., of New York City, under the direction of Colonel Pope, and catalyst plants, designed and put into operation by the same American chemical engineers working under the direction of C. O. Brown; also plants for the manufacture of nitric acid, phosphate, nitrate and sulphate of ammonia, caustic soda, chlorine, and bromine. A second unit of the combine is under construction at the present time.

Bobriki, 200 km. south of Moscow, is an important center for electrochemical industries. Over 260,000,000 tons of coal is found in this vicinity, also important deposits of fireclay, gypsum, iron ore, phosphates, and a good grade of quartz sand, suitable for glass manufacture. Plans have been made for the production of nitric acid and nitrogen fertilizers; aluminum, alumina, and aluminum salts; sulphuric acid and ammonium sulphate; cement, brick, and ceramic products. The output of this combine alone is expected to be two and a half times the entire output of all chemical plants in Russia in 1913. Most of the equipment used is made in America as, for example, the synthetic ammonia plant already mentioned. Modern roads and large groups of apartment houses are included in the building program.

The large Chernoreznitsky (Black River) combine near Nizhni Novgorod includes plants for the manufacture of carbide and cyanamide, sulphuric acid, and nitric acid. The latter plant, designed and built by duPont, incorporates the latest pressure oxidation system. American equipment is used throughout. A similar nitric acid plant has also been built near Kiev, in the Ukraine.

Measuring temperatures of coke ovens at Kuznetstroi

Construction activities during the cold season in the Voskresensky District

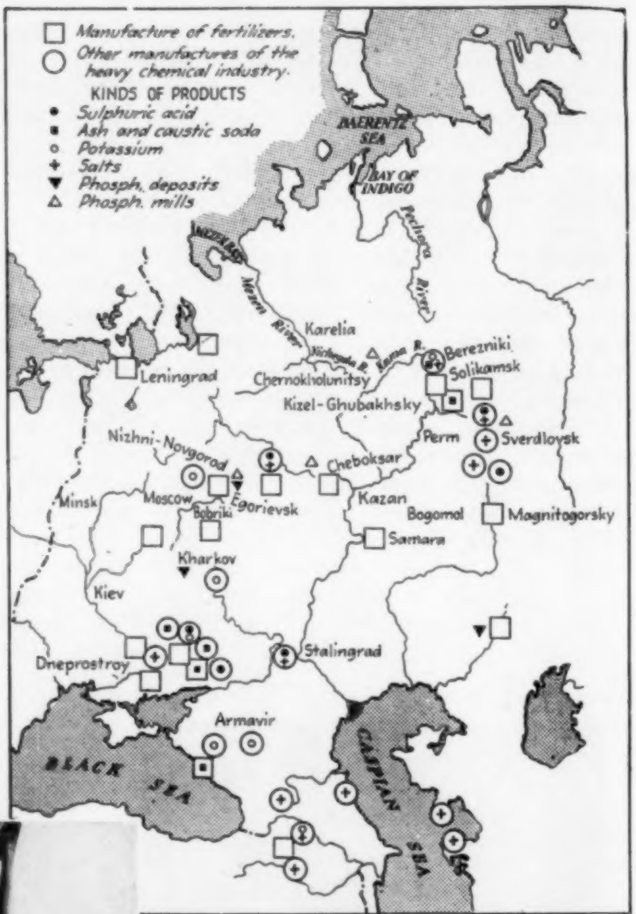
A large unit in the Leningrad district, an important market for fertilizers, includes plants for manufacture of sulphuric acid and superphosphate, and an American-equipped ore dressing plant, built by General Engineering, for treatment of apatite, which is obtained from the large deposits of the Kolsky Peninsula. A viscose plant is also being constructed in this district. At Kharkov a byproduct coke plant has been put into operation within recent months, with an annual capacity of 70,000 tons of coke. Important plants are also being constructed at Magnitogorsk, among which should be mentioned a plant for tar distillation and byproduct recovery, employing continuous distillation in the Becker type of oven. This plant was designed and built entirely by Soviet engineers. A total investment of $25,000,000 has been made at Magnitogorsk, and the combine includes units for production of sulphuric acid, nitric acid, ammonia, ammonium phosphate, ammonium sulphate, and ammonium nitrate. Hydrogen is obtained from the waste gases from coke ovens, supplying metallurgical plants. These products are also made at the Bogomol combine, in the Urals, where a total investment of $29,000,000 has been made. Roaster gases from the Bogomol copper smelter and coke-oven gas from the Nijne-Soldijny smelter are utilized in these plants.

Of great interest is also the sodium sulphate deposits at Karabugez, estimated at over two billion tons and of highest purity, free from magnesium salts. A large plant for the manufacture of artificial silk has been built at Perm. Intense activity is also displayed in the field of synthetic rubber.

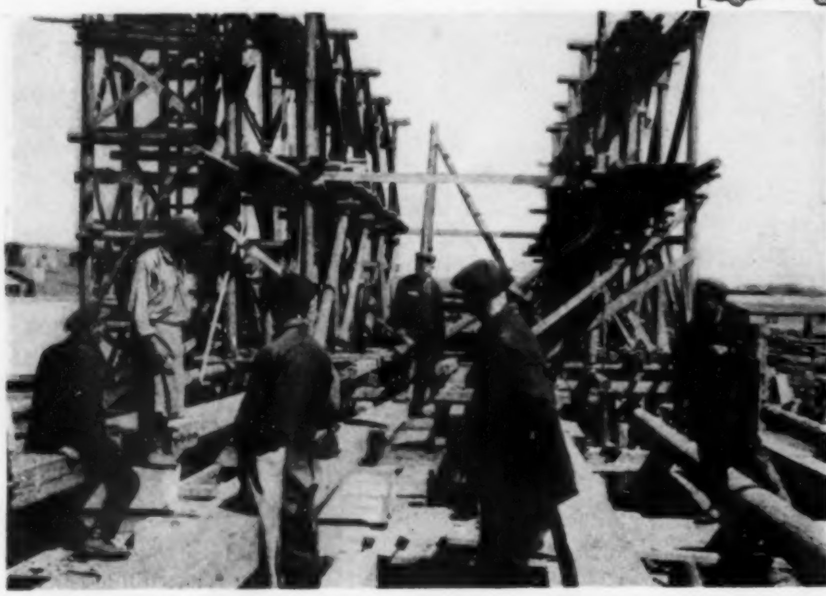
The Ukraine is an important market for most of the basic products of the chemical industry, and as a source of many of the raw materials of the chemical industry. Many coke ovens operate in this district, and cheap electric power has been made available through the giant power plant at Dneprostroy. Nitrogenous fertilizers and chemicals are being produced at Dneprostroy, where coke-oven gas from the Zaporojsky metallurgical plant is being utilized. The products are ammonium sulphate and ammonium phosphate, perchlorate and perborate, synthetic acetic acid, abrasives, carbon electrodes, and metallic sodium and magnesium.

Other important developments in the Ukraine are the Kemorovo combine, where synthetic ammonia and ammonium sulphate are produced; the Konstantinofsky plant, utilizing zinc roaster gases in the manufacture of sulphuric acid and superphosphate; the Slaviansk group, a new soda plant; and the Rubejansky and the Shterovsky sulphuric acid plants.

In the Central district, where the Egorievsk phosphate deposits and the coal fields of the Moscow region are the important sources of raw materials, the largest unit is the Egoriev combine, with an annual production of 100,000 tons of superphosphate, 100,000 ammonium phosphate, and 80,000 tons nitrate. To supply the needs



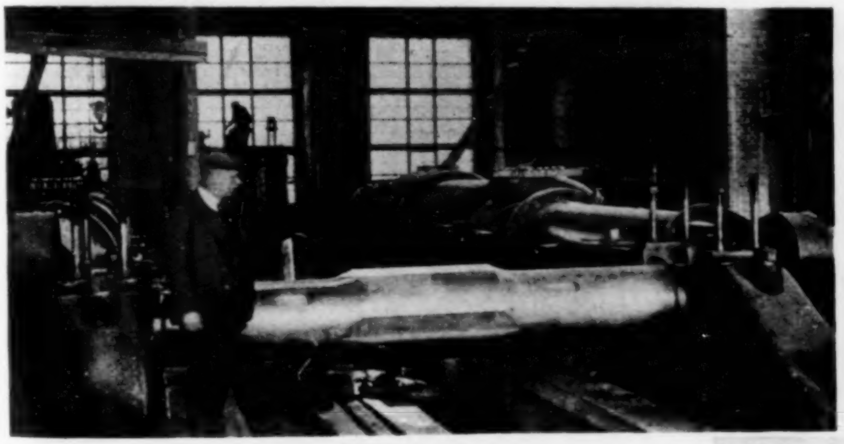
Chemical enterprises in operation and under construction in U.S.S.R.



Preliminary construction work at the Bobriki Combine, near Moscow

of these units the local phosphate mill has been enlarged to an annual capacity of 250,000 tons of ore, and a further extension to 400,000 tons annually is under way. Superphosphate is also produced by the Chernorechensky combine, at a rate of 115,000 tons per annum; the Bobrikovsky combine produces sulphuric acid and nitrate, methanol, and tar products. The Nevsky combine produces sulphuric acid, superphosphate, glauber salt, electrolytic zinc, and cement copper. In Karelia, near the Vichega River, plants have been built for the production of 60,000 tons of fertilizers and 60,000 tons of phosphate annually.

Three big dams with electric power plants are under construction on the Volga, one at Stalingrad, one at Samara, and a third at Cheboksar, near Kazan. These will provide water for irrigation and power for electrochemical industries. Two big dye plants are built by the Anilin Trust in Moscow, one in Leningrad, and one in Kharkov. Alizarine, indigo, and acid and basic dyes will be produced. Large viscose plants are planned at Leningrad, Moscow, and Minsk.



American engineer supervising the assembly of compressors to be used in synthetic ammonia plant

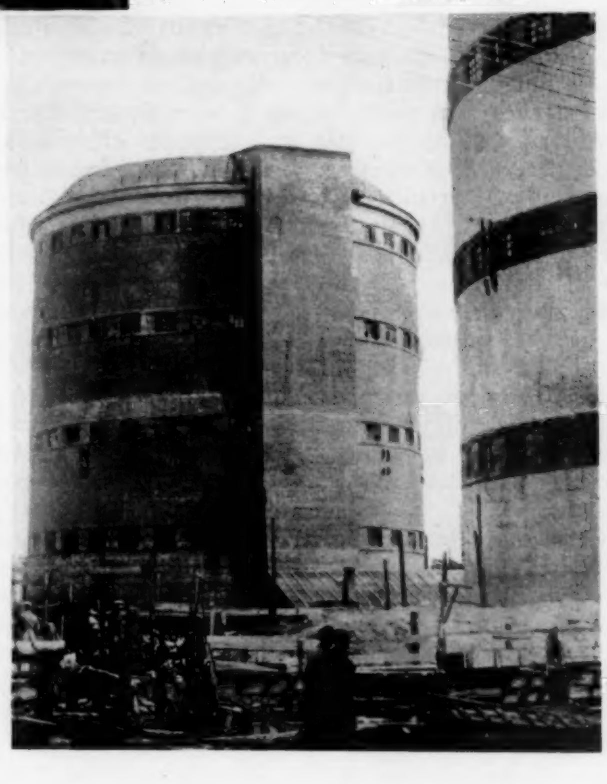
A large combine is in operation in Uzbekistan, Central Asia, for the production of nitrogenous fertilizers. Power from the hydro-electric plants on the Chirchik River is used for electrolytic production of hydrogen. In Siberia, a plant producing 60,000 tons of soda ash annually is being built in the city of Slavgorod.

An investment of $6,000,000 is planned for fertilizer plants in Kazakstan, including a phosphate mine near Aktiubinsk producing 300,000 tons annually. An alternative plan calls for an annual mine production of 1,000,000 tons of ore, which will be treated by flotation to yield 400,000 tons of 35 per cent concentrate, to be used for production of 20 per cent superphosphate. The plants are situated on the Tashkent railroad, near the mine. Sulphuric acid will be produced from Ural pyrites, of which 300,000 tons will be used annually. A contact acid plant is under construction in Transcaucasia. This plant will also produce caustic soda and alum.

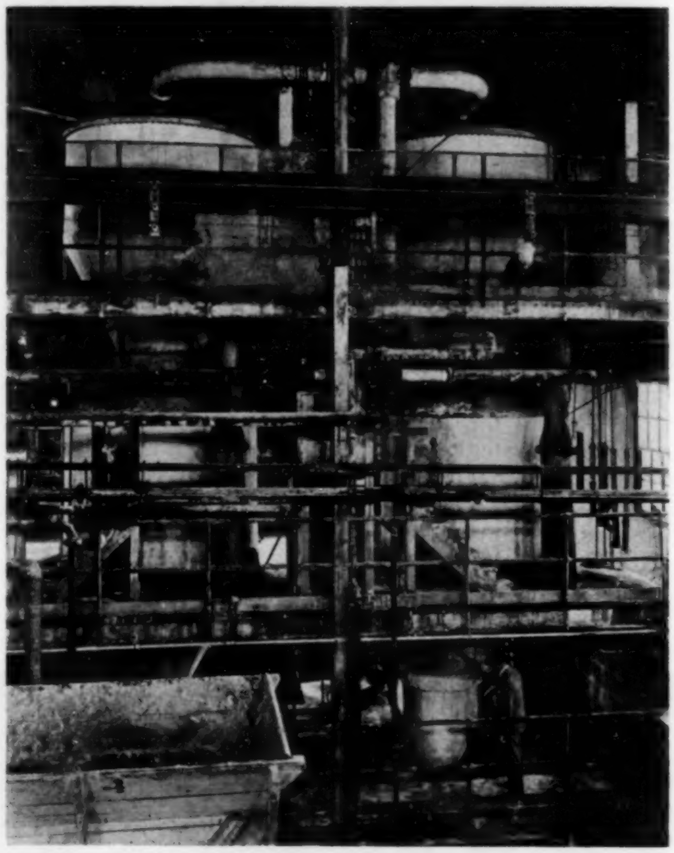
In the industrial development, great emphasis has been placed on research, of technical as well as of purely scientific nature. More than 50 technical institutes have been founded, employing over 10,000 scientifically trained men and women. Among the most important of these is the Karpov Institute, founded in 1919, where important work has been done in the study of artificial fiber, photographic film, and the production of aluminum from kaolin, of which large deposits are found in the Ukraine. Notable work has also been done in the utilization of chlorine and with plating of zinc, copper, and brass. Others worth mention are the Nitrogen Institute, the Leather Institute, the Institute for Textiles, all in Moscow; the Academy of Science, the Institute for Concrete, and the Institute for Ceramics, in Leningrad; the Coal Chemistry Institute in Kharkov; and the Ukrainian Institute for Radium Chemistry, in Odessa.

In the industrial program of the Soviet Union the rapidly expanding chemical industry is primarily serving as an aid in the agricultural development. The point has already been reached where the U.S.S.R. ranks high among the world's producers of fertilizers. Phosphates are found in abundance, and the waste products from the growing metallurgical industry supply raw materials for sulphuric acid manufacture and nitrogen fixation. Recent discoveries of potash minerals give promise of independence from foreign producers. Characteristic of the development is the tendency to centralize the industry at strategic points, so-called combines, where maximum coordination among related groups may be attained.

Waterless gas holders at the Berezniki synthetic ammonia plant



Double-effect evaporator-crystallizer for sodium sulphate in the plant of the Pyrites Co., Ltd.



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Supersaturation Control Attains Close Crystal Sizing

CRYSTALLIZATION, as a means of removing a dissolved substance from solution, is an important unit operation in many chemical processes. The efficiency of this operation as a rule determines the purity as well as the size and shape of the finished product and, besides, is of great importance in the heat economy of the plant. With these considerations in mind, it is surprising to observe that the advance in crystallization technology has been comparatively slow. Even today, many otherwise up-to-date chemical plants have in operation crystallization equipment that shows very little progress beyond the old system of crystallization by batches in open vats. Furthermore, most of the installations that are farther advanced from a technical point of view do not permit close control of this operation in order to secure uniformity of the finished product, particularly as regards high purity and even crystal size.

Consumer requirements as to crystal size and shape, and purity of the product, will vary greatly, of course, but in general the trend is toward purer and better looking chemicals of constant and frequently large crystal size. The conditions involved in obtaining such products have, to a certain extent, been discussed in the literature but the principal lack has been the evaluation and coördination of the determining factors so that the desired results might be secured. The important progress that has taken place in the control of crystallization in recent years has come about largely through an understanding of these factors, particularly through the discovery of that stage of supersaturation which has been called "metastable." This discovery was not a sudden one but was arrived at step by step, only in this century, by a number of distinguished investigators such as Ostwald, Miers, Isaac, Gibbs and Marc.

In 1906 Miers published some important observations regarding the behavior of supersaturated salt solutions. By investigating the refractive indices of supersaturated solutions, he observed that salt solutions in a closed tube could be considerably supercooled without the formation of crystals. If, however, the solution were cooled beyond a certain temperature, crystals would suddenly appear in the solution. He, therefore, distinguished between the metastable and labile field of supersaturation. In the former crystallization would only take place on a pre-existing crystal or an isomorphous substance, while in the labile field, crystallization would take place without any outside influence. The boundary line between the two fields he designated as the supersolubility curve. Some solutions may, under certain conditions, pass into the labile state of supersaturation without any formation of new crystals taking place, but

the maximum temperature at which the formation of new crystals starts lies on the supersolubility curve.

Of the factors influencing metastable supersaturation, the following only are to be mentioned here: kind of salt dissolved, temperature (quantity of salt dissolved), kind and quantity of dissolved foreign salts, viscosity of the solution, and the nature of the solid impurities that may be contained in the solution. Practical measurements of the metastable supersaturation for many different solutions have shown that it usually ranges between 1 and 3 deg. C., corresponding to about 5 to 15 grams of the salt per liter of solution, and somewhat higher for salts which crystallize with several molecules of water.

Experience on controlled crystallization has shown further, that the formation of new seed crystals, or nuclei, requires *time*. This means that fine salt is not precipitated immediately after supersaturation is increased above the metastable limit. On the contrary, the liquor may be supersaturated into the labile field, say, for one or a few seconds, and if it is then rapidly mixed with less supersaturated liquor so as to bring the resulting solution within the metastable field again, practically no new nuclei will be produced. It is readily apparent that this is a point of great importance in the design of continuous crystallizers where a strong feed liquor must be added to a cold, slightly supersaturated mother liquor, practically without the formation of new nuclei.

For a given solution the rate of crystal growth is proportional to the degree of supersaturation. As the region of metastable supersaturation of a solute commonly may be increased substantially by the addition of certain foreign salts and organic substances, one might infer that such additions would form a useful means of obtaining an increased rate of crystallization and hence increased capacity of a given installation. This, however, does not seem to be the rule. On the contrary, a given salt solution with high metastable supersaturation usually has a low rate of crystal growth. In most cases known to the authors, the presence of large quantities of foreign salts in solution has reduced the capacity of the apparatus, despite the fact that the metastable region in one case was increased about five times. Foreign substances which cannot enter the crystal lattice evidently impede the rate of crystallization. Furthermore, Jenkins has proved that the temperature coefficient of the rate of crystallization is governed only by the change in the viscosity of the solution with temperature.

Criteria for Crystallization Control

The factors of prime importance in the design of equipment for controlled crystallization may be summarized as follows:

1. The solution must not be supersaturated beyond its metastable limit. It is only when this limit is exceeded that precipitation of salt on the walls of the apparatus and an uncontrollable formation of nuclei occur.

2. To prevent excessive supersaturation and still render possible a high rate of production, a large total crystal surface is required and its efficient utilization must be secured by exposing the crystals to fresh solution supersaturated to the maximum degree.

3. The crystals must be kept in constant motion to prevent their growing together, but this motion must not be so violent that too large a number of new crystals will be formed by attrition.

4. In order to secure even crystal size, the formation of new crystals or nuclei should equal the number of full-grown crystals produced and removed.

Crystallizing Technique, Past and Present

Crystallization in open vats has been used for centuries, and is even today used quite extensively. The removal of heat takes place from the surface of the solution and through the walls of the vat only, and as soon as a deposit of salt is formed on the latter, the transmission of heat becomes extremely slow. In addition, as the supply of supersaturated solution to the crystals is effected by convection currents and diffusion only, the production rate will be quite minimal. Such vats need much floor space and operating labor is an excessive item in the total operating cost.

Large crystals can be produced in unagitated vats, but the crystal size is uneven, and crushing and screening of the product are often necessary to meet trade specifications. Agglomerates of crystals which occlude impure mother liquor are formed and any dirt in the liquor settles to the bottom and partly goes into the crystal layer.

A great improvement in control of crystallization and the capacity per unit of the ordinary stationary crystallizer has been the addition of mechanical agitation which materially increases the rate at which solution supersaturated at the cooling surfaces can be brought in contact with the crystals.

A most efficient way to remove the heat in the crystallization process is to utilize the sensible and latent heat available to concentrate and cool the solution. This principle has been employed in the vacuum crystallizer which has been used in several of the large industrial installations in Europe and, more recently, in the United States. The elimination of cooling coils, or jackets, and agitating devices simplifies the design so that continuous operation can easily be arranged. The operating temperature can be kept constant and crystallization can be carried out below the temperature of the available cooling water by installing a thermocompressor between the crystallizer and condenser. The productive capacity of such equipment can be very high, but only fine salt is produced.

Regarding the common single- and multi-stage evaporators, their economy and productive capacity are well known. Developmental work is also going on in this field. Better heat transmission is aimed at and scale formation has to be overcome. In many cases the fine grained-product produced does not satisfy the consumer. As a remedy for these disadvantages forced circulation has been introduced and to some degree has proved successful. Notably, the scaling of the apparatus has been reduced. However, only minor improvements have been made in crystal size by forced circulation alone, and further progress seems feasible only if due regard is given to metastable supersaturation as the basic factor so far as incrustation and controlled crystal formation are concerned.

The first deliberate application of metastable supersaturation seems to have been made in the Wulff-Bock crystallizer which has been used in Europe for many

years. This crystallizer uses a flat, elliptical trough, slightly inclined, which is rocked from side to side to provide circulation. Operation is continuous. Uniform crystals of even size can be produced, but as the heat is removed by natural convection only, the capacity is comparatively small, and the cooling temperature is limited to that of the air.

One of the most recent developments, introduced a few years ago in Europe, is the Oslo crystallizer which, in the opinion of the authors, is the first one fully to apply the known laws of crystallization. This apparatus was rendered practicable only after a simple way had been found to keep large masses of salt in ideal suspension without channeling. The system is further characterized by the fact that the supersaturation is produced at a point where there are no crystals present. The supersaturated solution is then passed through a large quantity of suspended crystals where the supersaturation is efficiently removed.

As an example, the following will illustrate the process in more detail: A solution of sodium nitrate, at a temperature of 100 deg. C., saturated at 90 deg. C., is to be cooled by vacuum cooling to 45 deg. C., at which temperature crystallization is allowed to take place. The equipment is outlined in the drawing, where pump, *f*, circulates the solution in the direction of the arrows from the crystallizing chamber, *e*, to evaporating chamber, *a*. As the only slightly supersaturated solution of about 45 deg. C. enters the outlet, *q*, feed solution at 100 deg. C. is continuously added at *t*, and the mixture becomes heated to some extent but not supersaturated. In the evaporating chamber, *a*, the solution then boils at 45 deg. C., the superheat of the feed solution and the heat of crystallization given off in chamber, *e*, being removed as steam.

Through the evaporation the solution becomes supersaturated, but on account of its continuous circulation, the degree of the supersaturation is not very great and always within the metastable field. For this reason no salt precipitation occurs on the walls of the apparatus, as the supersaturation under these conditions can only be deposited on pre-existing $NaNO_3$ crystals. This takes place as the supersaturated solution passes through the crystals kept in suspension above the suspension plate, *d*, whereby the crystals grow in size.

In this crystal suspension, the largest crystals always remain near the plate, *d*, sinking as they grow to proper size into elevator, *m*, which continuously removes them. The quantity of crystals kept in suspension, which controls the size of the crystals produced, is regulated by the valve, *p*. Excess mother liquor continuously overflows through the pipe, *n*, at a temperature of 45 deg. C.

As a result of these operations about 45 per cent of the $NaNO_3$ content of the feed solution is crystallized out, while about 20 per cent of the water is evaporated. Should it be desired to evaporate more water than the superheat of the feed liquor and the heat of crystallization permit, a heater can be installed between the pump, *f*, and the chamber, *a*. Because of the rapid circulation and the freedom from scaling inherent in this type of equipment, heater operation is at a very low temperature gradient which insures greater heat economy than is possible with other types of salting-out evaporators.

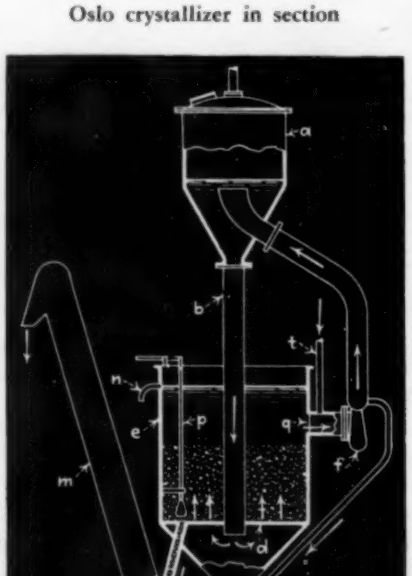
One of the primary reasons for the successful performance of the Oslo crystallizer is the design of the perforated bottom, *d*, above which the crystals are kept in suspension and in constant motion. Since the total cross-section of all perforations is small, the bottom offers the necessary small resistance to circulation and insures an even distribution of the liquid through the crystal bed, thereby preventing channeling. By this means a comparatively small quantity of crystals very efficiently removes the supersaturation from the circulating liquid, making possible rapid growth of the crystals.

Power consumption of the circulating pump is not large owing to the low resistance to the flow of the liquid. Thus, a unit for the production of 60 metric tons of $NaNO_3$ per 24 hours requires only about 12 hp. As now perfected, these crystallizers show a large productive capacity combined with excellent heat economy and close control of the crystal size. According to requirements, they may be built for multiple-stage evaporation, evaporation with recompression of the vapor, vacuum cooling, or cooling to low temperatures with cooling liquid.

It is interesting to note that salts like anhydrous Na_2SO_4, $Na_2CO_3 \cdot H_2O$ and others, the solubility of which decreases with rising temperature, can be produced as coarse-grained crystals under intensive evaporation without scaling on the heating surfaces or other operating difficulties. It can also be mentioned that in cases where two salts are precipitated simultaneously the one may be recovered in a coarse, granular form while the other is removed separately as fine salt.

As yet the Oslo system of crystallization is not very well known in the United States. Two installations have been made here, one of which employs double-effect evaporation for the crystallization of anhydrous sodium sulphate (Pyrites Co., Ltd., Wilmington, Del.). In Europe, however, the system has been adopted for various purposes by a number of large chemical concerns and installations of capacity as high as 60 metric tons per 24 hours have been made recently and operated with entire success.

Oslo crystallizer in section



PLASTICS
AS ENGINEERING MATERIALS

The popularity of plastics for use as equipment has extended to almost every process industry; but since it has been difficult to obtain reliable information on the industrial applications, *Chem. & Met.* has asked three General Electric Co. engineers to prepare for publication a summary of some of these uses

▼ ▼ ▼

Uses of Phenolic Laminated and Plastic Molded Products

By H. M. RICHARDSON
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DURING the past few years the group of materials known as the "Plastics" has been undergoing a rapid development which has resulted in new products with unique combinations of physical properties. These properties have been used to great advantage in many industries and are finding more and more useful and economical applications.

The outstanding characteristics of this group of products are, in general, the following: (1) relative inertness to corrosion and other chemical action, (2) structural strength, (3) resilience to absorb mechanical shocks, (4) low density compared to other structural materials, (5) electrical insulation value, (6) low heat conductivity, and (7) versatility of form.

A large number of grades and compounds of these materials with different types of fillers and binders have been perfected to give combinations of the above characteristics in almost any proportion. Certain grades excel in mechanical strength and resilience; others have outstanding electrical properties. Some are more inert to the action of high temperatures and the electric arc, while others resist water absorption and the action of most chemicals. Some are susceptible to molding into intricate shapes, while others are more readily machined to the desired form.

Rayon spinning bucket made of a plastic material

Plastics are almost always classified as follows:

1. Laminated, using synthetic resin binder of phenol-formaldehyde type.
   a. Cotton cloth filler.
   b. Asbestos cloth filler.
   c. Rag paper filler.
   d. Kraft paper filler.
   e. Asbestos paper filler.
2. Hot molded, using synthetic resin binder.
   a. Wood flour filler.
   b. Cotton fiber or fabric filler.
   c. Asbestos filler.
3. Cold molded—with organic binder.
   a. Asbestos filler.
4. Cold molded—with inorganic binder.
   a. Asbestos filler.

Laminated grades are made primarily for mechanical and electrical uses and are produced in the form of sheets, tubes, and rods which may be fabricated into desired shapes. The laminated grades can also be molded into simple shapes of relatively uniform cross-section

or may be combined with some of the fabric filled molding compounds to form more intricate shapes.

In the chemical industry these grades have been used for: tanks and tank linings, pump blades and housings, bearings, piping, baffles and grids, electroplating barrels, valve disks or seats, packing and sealing rings, rayon spinning pots, gears, clutches, couplings, industrial truck wheels, table tops, and electrical insulation.

In choosing laminated material for a given application, the outstanding properties of each grade should be considered. For instance, the requirements of a gear are that the teeth shall be strong to carry the applied load, resilient to take up the impacts of gear tooth action, and resistant to wear and abrasion. The material used in this case has a filler of strong cotton duck.

For tank linings and baffles, a moisture-resistant material which will withstand mechanical shocks and abrasion is desirable. In this case the fabric filled laminated material is used with either cotton or asbestos fabric as the base. And for electrical insulation usually a paper base laminated material is used.

Bearings for use in chemical apparatus can be made of a special dense grade of paper base material, or of a fabric base material into which has been incorporated a certain amount of pure graphite. Piping can be made of a water resistant grade of paper base laminated tubing.

While these materials are resistant to practically all of the common solvents and to weak acids, they should not be used in contact with concentrated solutions of the strong acids which attack the fillers, or with strong caustic solutions which will soften the synthetic resin binder.

The outstanding characteristic of the hot molded plastics with phenol-formaldehyde synthetic resin binder is their versatility of form. They can be molded into intricate shapes, and, where made in large quantities, produced economically.

The wood-flour filled compounds have the best moldability and give products of the highest surface finish and most intricate design. Where greater mechanical strength and ability to withstand impact shocks is desired, the fabric or fiber filled compounds should be used. They cost somewhat more than the wood-flour filled compounds and cannot be molded into such complex shapes.

Asbestos as a Filler

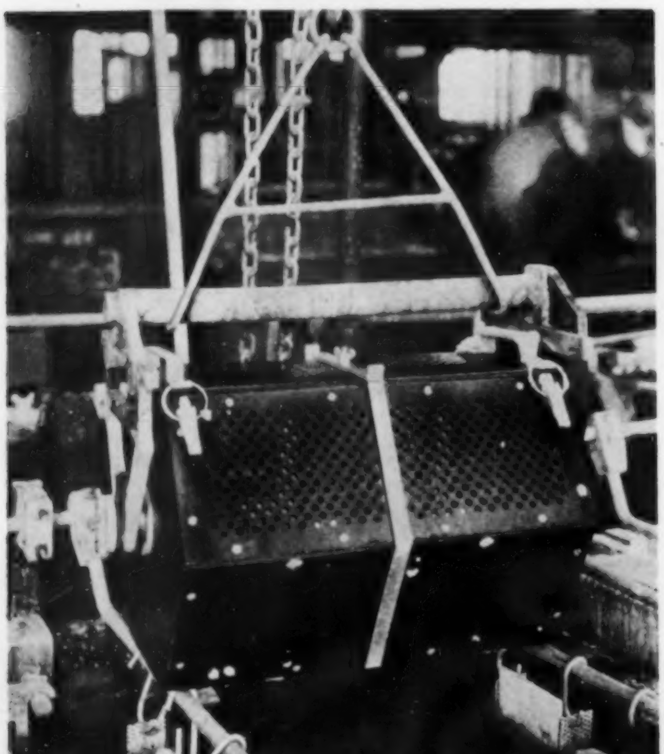
Applications which require resistance to temperatures from 300 to 475 deg. F. should use molded parts having a filler of asbestos. The asbestos filled compounds also have lower thermal expansion and water absorption characteristics than the cellulose filled.

Examples of hot molded parts are extremely numerous since their function may be mechanical, electrical, chemical, thermal, or decorative. There are few modern industries which do not use molded parts for the improvement of their product.

The cold molded materials differ from the hot molded in that they are molded at room temperature into the desired shape and then hardened by an after treatment which changes the binder into its finally stable form. Since these materials are merely molded and not cured in the mold, the operation is rapid, thus necessitating a smaller number of mold cavities for a given production than is required for hot molded parts. In general, cold molded parts are less expensive, especially where the number of parts to be produced is less than, say 10,000, as compared to hot molded parts.

While cold molded parts do not have the fine surface finish of the hot molded and must usually be designed with heavier section, they are definitely superior in both arc and temperature resistance. The nonrefractory grades, having an organic binder, will withstand temperatures of from 450 to 600 deg. F., while the refraction grade will withstand temperatures up to 1,800 deg. F. and is extremely arc resistant. It will, however, absorb somewhat more moisture than the other grades.

The uses of cold molded parts have been principally in the electrical industry on applications where the special properties of temperatures and arc resistance have been required of an insulating material.



Plating barrel is made of Textolite Laminated and has the quality of being resistant to acids

Alkyd Resins in Industry

By R. H. KIENLE and C. S. FERGUSON

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IN THE LAST decade synthetic resins in the form of varnishes, enamels or plastics, have become recognized as engineering materials. The possibility of manufacturing material possessing desired and reproducible mechanical, electrical, and chemical properties has been largely responsible for their use. With increasing use the cost has decreased until today synthetic, or perhaps better artificial, resins are as much raw materials of construction as cement, wood, and metals. Artificial resins or the products produced therefrom have found a place in almost every industry. As engineers are becoming better acquainted with these materials and products, their employment is extending even further. The industrial possibilities are, therefore, just beginning.

Up to a few years ago the principal industrially useful artificial resins were the phenol-aldehydes. This class probably still leads the field in quantity consumed, although lately the alkyd resins, that is those products obtained by the condensation of polyhydric alcohols with polybasic acids, have assumed increasing importance. It is, therefore, of interest to survey some of the industrial uses of the alkyd resins.

Three Types of Alkyd Resins

In general it has been found possible to prepare three classes of alkyd resins: heat non-convertible, heat convertible, and element convertible. Resins prepared from dihydric alcohols and dibasic acids, such as glycol and phthalic anhydride respectively, illustrate the heat non-convertible resins. Heat convertible resins can be prepared from polyhydric alcohols, with three or more OH groups, and polybasic acids; for example, glycerine and phthalic anhydride or glycerine and adipic acid. Element convertible resins result when unsaturated acids or alcohols, such as the oxidizable unsaturated acids of a drying oil, are used either as modifying agents or as an integral part of the resin.

The physical characteristics of all three types of alkyd resins can be widely varied. Thus, depending on the kind and proportion of alcohols and acids used, resins can be prepared ranging from soft balsams to hard brittle types similar to common rosin.

Recently it has been found possible to obtain permanently flexible resins in each of the three classes mentioned above. This should greatly extend the possibilities and uses of the alkyd resins. These flexible resins are also more plastic, thereby lending themselves to fabrication by using celluloid and rubber technique. The use of the flexible resins in this manner, resulting in the so-called plastic alkyd resins, has been described by Wright in *Chem. & Met.* Vol. 39, p. 438 (1932).

There are certain common underlying characteristics of the alkyd resins which, regardless of their class or physical form, are largely responsible for their industrial usefulness. These characteristics are durability, heat resistance, oil resistance, acid resistance, ultraviolet resistance, high dielectric strength, non-tracking properties, adhesive properties—when in fusible or semi-fusible state—convertibility, to infusible if desired, and decomposition without appreciable gumming at high temperatures.

For the purpose of simplicity in treatment the industrial applications of alkyd resins, irrespective of class, will be taken up: first, when used as a solid; and second, when used in solution.

The heat convertible type of alkyd resin can be readily cast into rods or sheets. When so cast and cured by carefully heating for prolonged periods of time at temperatures ranging from 125 to 175 deg. C. hard, tough, amber products result. By pigmenting or dyeing these products prior to casting, beautiful effects are obtained. These cured resins can be readily machined and fabricated into various forms and shapes, and have thus found use in the manufacture of various articles, such as jewelry, penholders and pencils. They are particularly in demand because of permanency of color and shock resistance.

Heat Convertible Type in Sheet Form

By properly adjusting the composition of the flexible forms, sheets can be produced which resemble celluloid in workability and strength, although differing in being non-inflammable, odorless, and non-shrinkable. These products can be shaved, polished, drilled, but cannot be molded except under very special conditions.

The principal drawbacks to the use of alkyd resins have been the length of curing time necessary and the difficulty in accurately ascertaining the correct degree of cure. However, some recent developments have tended to correct materially both these defects. At the same time there has been introduced the property of casting directly into molds and subsequently removing therefrom, thus minimizing machining and finishing operations. This new form of quick curing and casting of alkyd resin gives considerable industrial promise.

By careful preparation and tinting, practically water-white transparent sheets can be prepared, resulting in such applications as instrument parts and as non-breakable glass substitutes.

One of the chief industrial applications of alkyd resins is as a cementing agent or sticker, which is particularly useful in the manufacture of both flexible and rigid mica products (Barringer, *General Electric Review,* Vol. 29, p. 757 and Vol. 32, p. 530). In this use they have given new and improved results over other stickers. Further adhesive applications are in connection with asbestos products, as an ingredient in the more improved lacquer cements. In this regard the heat non-convertible resins are interesting. Glycol phthalate or similar resins are useful as a sealing compound for building up and maintaining high vacuum systems.

Uses of Alkyd Resins

Another rather extensive use of alkyd resins in the solid state is as a binder or as a constituent of the binder of cold molded compounds. Usually in this application some solvent is added to effect a thorough dispersion of the binder with or over the filler, such added solvent being removed prior to the molding operation. Cold molded products thus produced are subsequently heat cured, finally yielding a compound of good mechanical

strength and electrical insulating value, but particularly with excellent tracking resistance.

Alkyd resins are also used as binders for inorganic fillers when intricate articles or shapes are to be formed from these fillers, from which later the binder is to be removed as, for example, by firing. The property of most alkyd resins to volatilize at very high temperatures without leaving a residue is useful in this connection. Applications of this type are found in the manufacture of foundry cores and in the applying of inorganic insulating materials. (Hovey, U. S. patent 1,842,970).

A still further interesting and seemingly fruitful field is that of the flexible resins. By employing suitable technique, these resins can be handled like rubber. When so fabricated, a series of products result which possess moderate elasticity, good flexibility, strength, heat resistance, and oil resistance. Due to the plasticity induced by the flexibilizing agent and by the method of fabrication, the alkyd resins in this so-called plastic form can be extruded, sheeted, calendered, and molded. Either rigid or flexible products can be prepared. These so-called plastic alkyd resins and compounds find use as printing rolls and oil-proof gaskets. As this form of resin and method of handling is relatively new, undoubtedly numerous other uses will result.

Alkyd Resins as Film Forming Materials

It was probably the recognition of the usefulness of alkyd resins as film-forming materials (Kienle and Ferguson, *Ind. & Engr. Chem.*, Vol. 21, p. 349) that has resulted largely in their commercial importance. Large quantities are now annually produced and used in this manner. Their introduction has definitely changed the trend of the paint, varnish, and lacquer industry.

Nevertheless, the first use of alkyd resins as film forming materials was in the electrical industry where their adhesiveness, penetrability, high solid content for a given workable viscosity, durability, and oil resistance proved of value. Applications in the electrical industry are for such purposes as protective varnishes for insulating coils, motors and the like, as cementing varnishes for building up composite insulation, and as wire enamel compounds.

In the paint and varnish industry as a whole their use has resulted largely from the peculiar combination of properties they possess. Outstanding among these properties are exceptional weather resistance, ability to retain gloss over long periods, excellent flexibility, adhesion, and flow. Films of these resins are ideal for use when oil or gasoline resistance is required. Most of the resins are also outstanding for use in baking whites and light colors.

Resins in Finishes

The resins are being used successfully in practically every type of finishing, either air dry or forced dry. They have produced one of the most satisfactory refrigerator finishes due to their remarkable humidity resistance, yellowing resistance, and grease resistance, and their retention of adhesion and flexibility. As a bus and truck finish, gloss retention, flexibility, quick drying, and weather resistance have made them successful. Lithographic inks have been reported as improved by their use. Gloss retention and gasoline resistance have made them excellent materials for use in enamels for gasoline pumps and tanks. The resins have also proved themselves of value in various other lines of finishing, such as metal furniture, automobile parts, toys and freight cars. The results of a great deal of more recent experimental work have shown that the durability of house paints can be remarkably improved by using alkyd resins, and these paints are now making their appearance on the market. Finally, nitrocellulose lacquers have been improved considerably in durability and flexibility by incorporating alkyd resins therein, thus making their use in lacquers significant. The importance of the alkyd resins in the paint, varnish, and lacquer industry is thus evident.

For use in solution, alkyd resins are manufactured at present either as solids or semi-solids to be later blended with other ingredients such as cellulose esters, ethers, other resins, plasticizers, oils and pigments; or are dissolved in suitable solvents and furnished as base solutions of about 50 to 80 per cent solid content.

The possibilities in the alkyd resins are just being recognized and are by no means exhausted. Further research and development will give us a better understanding of them, and with this understanding will undoubtedly come improved resins, newer resins, and simultaneously a further extension of their uses.

HIGH-ALLOYED CAST IRONS

AS A RESULT of the depression there is a demand for inexpensive metals that are corrosion-resistant. In response to this demand, the metallurgists are developing a series of alloyed cast irons. The newest members of the group are the high chrome cast irons ranging from 15 to 30 per cent chromium, developed by the Union Carbide & Carbon Corp. The quantities of the other elements are in general similar to those of cast iron, but are regulated according to the many service requirements.

These cast irons are suitable for casting in intricate forms and have considerable resistance to oxidation, high temperatures, and some forms of corrosion. Owing to their high carbon content, they are relatively hard, and in physical properties are nearer to cast iron than to steel. They are not recommended for the replacement of stainless and heat-resisting steels under conditions of stress, but rather of cast and malleable irons which have a tendency to deteriorate or grow at high temperatures and under corrosive influences.

High chrome cast irons can be heat-treated, and a wide range of physical properties is possible. The tensile strength ranges from 25,000 to 90,000 lb. per sq.in. and the brinell hardness number varies from 228 to 600. As indicated by the brinell hardness number, some grades of the metal can be machined readily as cast—others are not machinable. Preliminary research work indicates that owing to their high chromium content, these new cast irons will have value along lines of corrosion resistance, although investigations are not yet complete.

It has been shown by accurate tests on samples subjected to synthetic smoke atmospheres for 500 hours that a protective coating is formed which almost completely stops the loss of waste.

A New Type of Shatter-Proof Glass

By M. NAPHTALI
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Germany

A RADICAL DEPARTURE in the manufacture of shatter-proof glass has taken place in Germany. Sekurit glass, as the new product is called, is made from highly polished sheets of plate glass, treated by a special hardening process which does not affect the transparency, and which obviates the necessity of an adhesive medium between the individual plates. Remarkable qualities are imparted to the glass by this process. The brittleness is greatly reduced, and its high elasticity and flexibility remind one of spring steel.

Mechanical Properties of the Glass

A ¼-in. plate, 4x1 ft. when supported at both ends, easily carried the weight of three men without breaking or being permanently deformed. When destroyed by violent impact Sekurit glass does not break into long, sharp splinters, but falls into small rounded pieces, which cannot inflict any serious injury in case of accident. A broken plate has a honeycomb structure, from which the small pieces readily come loose.

Defects in fabrication cannot occur, as plates that have not been sufficiently hardened will break in the later stages of the manufacturing process. This glass has a remarkable resistance to temperature changes. A plate exposed to molten lead does not crack, neither is its transparency impaired from attack of the surface by the hot metal. In one test a plate was heated to 268 deg. C., then plunged into a salt bath of —7 deg. C. without any damage occurring. Vibration and repeated impact are likewise without harmful effect. A plate, 3½x1 ft., when subjected to 800 vibrations per minute, gave no evidence of change after 400,000 impacts. Other tests have revealed high resistance to torsional stresses, a property of great importance in mounting glass and in the construction of automobile bodies and other equipment used in the transportation field.

In the process of manufacturing the plates are first cut to exact dimensions; after heating to the desired temperature they are carefully cooled by properly adjusted air currents, blown vertically against, or horizontally across the plates. The process does not really involve any hardening, but rapid cooling sets up certain stresses in the glass; in the center the glass is under tension, at the surface a compressive force is in evidence. When a plate of this type is exposed to a blow or a bending stress, the compressive force at the surface must first be overcome before the glass can be subjected to any tension; the latter stress is the most dangerous, as the resistance of glass to tension is only 2,750–8,250 lb. per sq.in., whereas resistance to compression exceeds 70,000 lb. per sq.in.

That the glass falls into small pieces when destroyed is explained in the following manner: The heat treatment to which the plates have been subjected sets up latent stresses in the glass, stresses, which, however, are in equilibrium. If this condition is disturbed at any point, the stresses are released, and strong shearing stresses are set up at the point of impact; these cause the glass to break into small pieces vertically to the direction of the main force, causing the destruction to spread from the point of impact toward the edges. This behavior also explains why a diamond cannot be used for cutting these plates.

Tests with Sekurit glass in the Prussian Laboratory for Testing Materials showed a resistance toward bending from 27,500 to 40,000 lb. per sq.in., according to the thickness of the plate tested, whereas ordinary plate glass only gave 4,125 to 8,830 lb. per sq.in.

Tests on impact strength made in the same laboratory were performed with small 10-in. squares at 20, 40 and —20 deg. C. The squares were placed on an 8-in. steel ring, imbedded in sand, and held securely by another ring, the lower edge of which was equipped with rubber. Steel balls were dropped from varying heights on the center of the sample plates, and the impact strength was measured in kilogrammeters, according to the weight of the ball and the distance required to break the sample. Plates of ¼-in. thickness showed impact strengths from 0.36–0.72 kg.m. (2.3–4.6 ft.-lb.); for ordinary plate glass the corresponding figure was 0.09 kg.m. (0.6 ft.-lb.). Rectangular plates, 3x1½ ft., supported on both ends, were also tested by dropping steel balls on their centers. Impact strengths from 2 to 5 kg.m. (14.5 to 36.3 ft.-lb.) were obtained. The steel balls used weighed from 1 to 2.9 kg. (2.2 to 6.4 lb.) and were dropped from heights between 1.3 and 2 m. (4 to 6.5 ft.); the larger fragments of the glass were penetrated by a fine network of cracks and could easily be crumbled with the fingers into smaller pieces, the size of a pea.

In Germany, Sekurit glass is manufactured by Herzogenrather Glaswerken Bicheroux & Cie., G.m.h.H., Herzogenrath, Rheinland; market price is $1.60 per sq.ft. for material 0.2 to 0.4 in. in thickness.

It is used in the manufacture of automobile bodies, street cars, railroad coaches, in advertising and display equipment, and in laboratories and chemical factories, where glass of high heat resistance is required.

Resistance Built Into Cellulose Board

SURFACE treatment, while often adequate and economical, has some practical shortcomings that caused the Celotex Company to give its insulating board an integral treatment. Its objectives were resistance to fungus and termite attack, which is getting into the Northern states, and adaptability to the demands of construction. It achieved this by a so-called Ferox process, whereby the wet bagasse fibers are treated with a toxic, permanent chemical before their compression into structural board. The treating agent dries to an insoluble, non-volatile ingredient which is harmless to human beings and does not affect the properties of Celotex in any other way. Because it is integral, no special precautions of construction are necessary; the board can be cut or pierced without losing its resistance.

Choosing Pipe Line Sizes for Maximum Economy

By M. FUNDER

Formerly Chief Engineer
Diamond Alkali Co.
At Present With Giproazot
Kharkov, U.S.S.R.

A PROBLEM which frequently presents itself to the chemical engineer is the selection of the proper size of pipe for conveying a gas or a liquid. In most cases insufficient care is given to this question, with the result that much piping is installed which, although apparently functioning well, is not the best that might have been selected.

Frequently, use is made of a chart plotted from a formula, such as that of Williams and Hazen for water, and the pipe size selected so as to give a certain frictional loss per 1,000 ft. of pipe. Or selection is made on the basis of an assumed proper velocity of the fluid in the pipe, or again, some rule-of-thumb method may be used.

All of these methods are unsatisfactory unless used by an experienced engineer, since they give no assurance that the best size has been chosen. The only proper way is to select the size which is the most *economical,* that is, the one which gives the least yearly expense, when all factors are considered.

When we select pipe sizes this way and compare the results for different sizes, each one of which is the most economical within its range, we will find a considerable difference between the various sizes, both in the velocity of the fluid and in frictional loss per 1,000 ft. of pipe. This will be exemplified later.

In order to make such a determination in the basis of economy, it is necessary to know or estimate certain factors, namely the cost of the pipe erected in place, say, for 1,000 ft., and the cost of pumping.

Defining Yearly Expense of Piping

On the basis of these data, the yearly expense of a gas or liquor line may be calculated. It is made up of two parts, the first being the fixed charges, which include interest, taxes, and depreciation on the investment. The second part is the pumping expense, and for comparison, in order to find the most economical size, we need only consider the cost of pumping against the friction head. The pressure head is, of course, the same for any size of pipe, consequently this part of the pumping expense remains constant and for comparison, need not be considered. The velocity head should, strictly speaking, be considered, but in most practical cases it is very small. Since we are here concerned only with the differences in total head, velocity head may be neglected without any appreciable error in the result.

For pipe lines requiring considerable expenditure in installation or in operation, such as long water or gas lines, an independent investigation should be made in each case, and the most economical pipe size found by comparing the yearly expenses for each size within the possible range. But for general plant piping it is of great convenience to have a graph, representing average conditions. To prepare such a chart is only a matter of a few hours work, but it may save thousands of dollars in the aggregate.

One way of preparing the chart, which the writer has

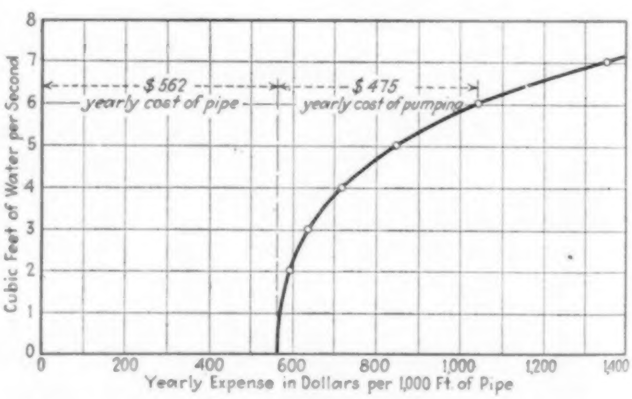
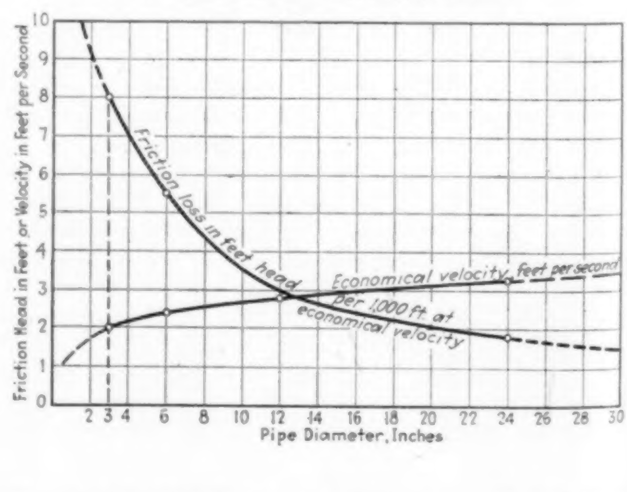


Fig. 1—Total yearly cost of 1,000 ft. of 16-in., 62-lb. pipe at various flow rates

Fig. 3—Most economical flow velocity and corresponding friction loss for various pipe sizes



found convenient, is illustrated below for water piping.

We will make the following assumptions: Cost of pipe erected, 6 cents per pound for all sizes; cost of current at the switchboard, 1 cent per kilowatt-hour; overall pumping efficiency, including other pumping expense, such as to make the cost of one theoretical water horsepower 2 cents per hour.

In Fig. 1 is given a curve which represents the yearly cost of a 16-in. pipe 1,000 ft. long, plus the cost of pumping water against the friction head for various capacities. It is arrived at as follows:

The weight of 1,000 ft. of pipe is 62,600 lb. and the cost erected \$3,756. For interest, amortization, taxes, etc., we will assume 15 per cent yearly or $0.15 \times 3{,}756$ equals \$562.

To this fixed charge must now be added the cost of pumping. The cost is calculated for different quantities of water pumped and corresponding points are plotted on the curve. As an example we will calculate the expense for 6 cu.ft. per second. From a flow diagram it may be found that the friction loss in 1,000 ft. of pipe is 4 ft. head. The theoretical water horsepower is then:

$$\text{Hp.} = \frac{6 \times 62.4 \times 4}{550} = 2.71$$

The cost of pumping is then: $2.71 \times 2 = 5.42$ cents per hour or \$475 per year. The total yearly cost for this case is \$562 + 475 or \$1,037.

Economic Data on Pipe Lines Under Assumed Conditions

Diameter of pipe, inches	3	6	12	24
Cost of 1,000 ft. of pipe, dollars	450	1,140	2,620	5,680
Fixed charges, 15 per cent per year	68	170	390	850
Economical flow, cubic feet per second	0.1	0.45	2.2	10.2
Velocity, feet per second	2.0	2.3	2.8	3.25
Friction loss, feet head per 1,000 ft.	8.0	5.5	3.0	1.8
Yearly power cost, dollars	17	30	130	270
Total yearly cost, dollars	85	200	520	1,120
Total yearly cost for 1 cubic foot per second, dollars	850	444	236	110

Discovering Economic Size for Each Range

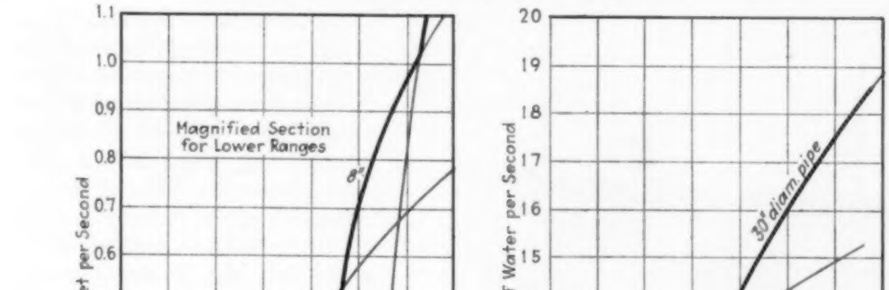
Fig. 2 shows a group of curves similar to that of Fig. 1, plotted for different pipe sizes and giving total yearly costs for different quantities of water pumped. Since the most economical pipe size is the one which gives the least total yearly expense, the economical range for each size may easily be determined from the chart. It is that part of each curve which is to the left of any other curve. For a 20-in. pipe, for example, the range is from 4.4 to 7.1 cu.ft. per second, which are the volumes at the intersections of the 20-in. curve with the curves for the 16-in. and the 24-in. pipes.

If, as is often the case in designing, it is necessary to keep down the first cost, then a smaller pipe size may be selected despite the fact that the flow volume will be somewhat above its economical range. In such a case the curves of Fig. 2 will help in deciding how far it may be advisable to go in this direction, as they will show the extra yearly expense immediately and will give an indication as to whether it may not be preferable to effect the needed economies in some other part of the equipment.

As it may be of some interest to see what the economical velocities are, and their corresponding friction losses, the accompanying table has been prepared, giving the results of calculations for 3-, 6-, 12- and 24-in. pipes. The flow has been assumed for each pipe to be the average flow within its economical range.

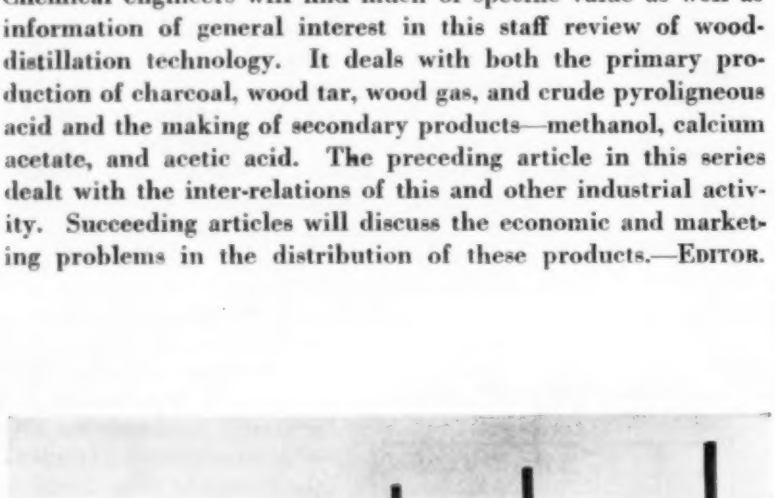
The curves in Fig. 3 represent the economical velocities and friction losses for different pipe diameters. Since they are based on certain economic assumptions they have a general application, only, in so far as they show that the most economical velocity is not constant, but increases with increasing pipe diameter. The friction losses on the other hand decrease in this direction and show a very much greater variation as the pipe size increases than do the economical velocities.

Fig. 2—Total yearly costs of various pipe sizes, per 1,000 ft., at various flow rates, showing economical range for each size



CHEMICAL ENGINEERING PROBLEMS IN HARDWOOD

Chemical engineers will find much of specific value as well as information of general interest in this staff review of wood-distillation technology. It deals with both the primary production of charcoal, wood tar, wood gas, and crude pyroligneous acid and the making of secondary products—methanol, calcium acetate, and acetic acid. The preceding article in this series dealt with the inter-relations of this and other industrial activity. Succeeding articles will discuss the economic and marketing problems in the distribution of these products.—EDITOR.



Loaded buggies, predryers of double width to serve two ovens, with fan and temperature control equipment on top, at the Tennessee-Eastman plant

HARDWOOD DISTILLATION plants have many problems of chemical engineering significance, notably those of efficient heat utilization, economical byproduct handling, and labor saving. Wide variation of practice has been found in the industry, as will be described later; but in the case of almost every plant problem of general interest, some plant visited seems to have a solution that is at least fairly satisfactory. It is hoped by the author that this description of the industry will aid each wood-chemical plant operator in finding at least a clue in the practice of others for the solution of some of his own most pressing problems. And if chemical engineers from other fields can find in these practices a helpful suggestion for their specialized work, this survey will have been worth while indeed.

Retorts for carbonizing wood are in most plants rectangular steel structures, holding 6 to 10 cords of wood per change on from 3 to 5 steel buggies. Only a few old-style round-retort plants remain, using the small cylindrical chambers charged by hand with approximately three-quarters of a cord of wood each. Only a single plant, that of the Ford Motor Co. at Iron Mountain, Mich., uses the Seaman and the Stafford processes which carbonize respectively fine wood and hogged wood in a predried form and produce fine charcoal which must be briquetted for the market.

The typical retort is of sheet steel approximately 6 ft. wide by 9 ft. high, hung inside a brick housing over its own furnace. The length of the retort is determined by the number of buggies per charge. Usually the 3-buggy retorts are closed at one end; but most 4- or 5-buggy retorts are charged at one end and discharged at the other. A typical buggy holds 2 cords of wood, or slightly less if the wood is treated in block form instead of in cord lengths of 48 to 60 in. The end or ends are closed by large steel doors hinged on the end flanges of the retort; practically gas-tight closure is secured by driving steel wedges into the latch blocks at numerous points about the flanged mounting.

All of the products volatilized from the wood pass through large offtakes on the side of the retort, or rarely at the top, directly into copper-tube condensers immersed in cooling water. Complete condensing of all tar, oil, acid, water, and alcohol vapors forms a mixture of tar, oil, and pyroligneous liquor, which drains

DISTILLATION

By R. S. McBRIDE
Editorial Representative, Chem. and Met.

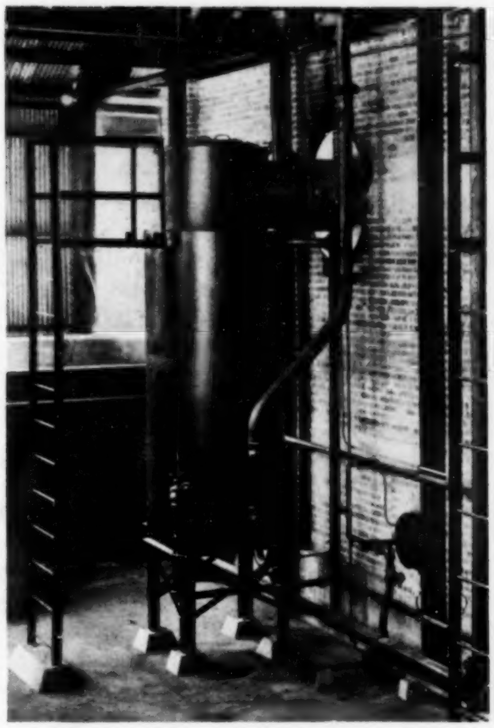
from the bottom of the condenser through a copper goose neck into the copper collecting main, and is gathered in the main crude-liquor sump. Wood gas passes out usually to be consumed immediately as a retort fuel.

Predrying of the wood before carbonization is essential. In a very few plants this is accomplished solely by seasoning of the wood in the yards of the plant. Most commonly the wood, either with or without such air drying in the yard, is treated in a heated predryer, a rectangular chamber of brick, tile, or concrete in which the loaded wood buggies are held for the requisite period exposed to warm products of combustion from the retort furnaces.

It is essential that a predryer be used if green or unseasoned wood is being treated. With green wood two days, or occasionally three days, in a predryer is essential. With well-seasoned air-dried wood sometimes predrying is limited to 24 hours. When no predrying is practiced other than yard storage, the quantity of water remaining in the wood entering the retort is high. Hence the bulk of pyroligneous liquor condensed per cord is correspondingly great. The cost in steam for refining is, therefore, much greater than with more concentrated crude liquor. It is estimated that each pound of water eliminated in the predryer saves from $2\frac{1}{2}$ to 3 lb. of steam in the chemical-refining operations. The claim that the use of predryers tends to reduce the yield of chemicals is a conclusion that apparently is correct only with excessive predrying.

The heat used in the predryers is usually the sensible heat of the products of combustion from the retorts themselves. Since the predryer is always located only a few feet away from and directly in alignment with the retort, a very small expense is involved in connecting the flue-gas outlet of the retort to the predryer. A fan is generally used for movement of the products of combustion, but in some few cases a stack draft on the outlet of the predryer suffices. The heat for the predryer under these circumstances costs nothing except the power to run the fan.

Automatic temperature control in the predryers is practiced by most modern plants by any one of several types of control familiar to chemical engineers in other industries. Reduction of the products of combustion to the desired temperature is accomplished by adjustment of the cold-air inlet damper on the intake of the fan. It is essential that the wood during drying shall not exceed 300 to 350 deg. F. lest it take fire. But if the wood is not brought up practically to the lower temperature named, the time is unduly long before distillation begins. Thus the importance of predryer temperature control is evident.



Completed retort showing condensers and their connections, the gas burners for heating the retort and other equipment

Retort fuel used in the industry varies widely. Some plants use natural gas or oil; some coal; many coal mixed with waste wood, sawdust, etc.; and all plants burn all of the wood gas made. A few burn tar under the retorts, but more commonly the tar not refined is used as boiler fuel. The quantity of heat required for the retorts corresponds to approximately 500 lb. of bituminous coal per cord of wood processed. In many cases there is direct flame contact from the fuel chamber against the bottom of the retort; but a few plants have Dutch-oven arrangements at the end, and nearly all have a refractory arch above the flame zone to secure better heat distribution and less warping of the retort bottoms.

The major problem in retort firing is to secure a slow even rise in temperature of the wood from the 300–350 deg. at which it enters from the predryers to 800–850 deg., the maximum at which the charcoal leaves the retort. In order to secure uniformity in temperature along the retort, all of the longer and many of the medium-length installations are fired from both

ends by two furnaces. Shorter retorts are frequently stoked from one end only.

The main job of the plant operators in charge of the retort house is to watch the outflow of products and control the firing rate in accordance with the desired heating schedule. Very few plants use indicating thermometers to show retort temperatures, and still fewer have recording-pyrometer equipment. In general the firemen of smaller plants gage operations by the volume, color, and taste of the pyroligneous acid flowing from the condenser and, to a lesser degree, by the volume of gas being evolved.

Operating schedules almost invariably call for one charge per retort per day. In most plants all the retorts are charged one after the other early in the day shift as rapidly as the full-working force can accomplish this operation. In a few plants half the retorts are charged in the morning and the other half late in the afternoon, just before the day shift leaves. Save under extreme pressure for operation above capacity, charging at less than 24-hr. intervals is not practiced, although under the war-time demand it was found feasible in a few works to charge at intervals of 20 to 22 hr. and secure complete carbonization of the wood.

In general the day shift includes all men involved in wood loading, as well as all charging and charcoal-handling operations. Night-shift men who generally work 12-hr. or longer shifts have relatively few manual duties except in case of fire, their responsibility being largely limited to stoking the retort furnaces and control of temperatures in predryers and retorts. Under such circumstances the day shift is usually from three to four times the size of the night shift. A limited number of plants operate on the 3-shift basis. Some operators claim that with three shifts the maximum labor economy can be secured, assuming proper distribution of duties.

The buggies, about two-thirds full of hot charcoal, are drawn from the retort over light rails laid temporarily from the retort to the first cooler. After 24 hours in it, the charcoal spends a like period in the second cooler, and in a very few plants a third day in a third cooler. These coolers, each almost identical in size with the retort, are about 12 ft. apart end to end in line with the discharge end of the retort.

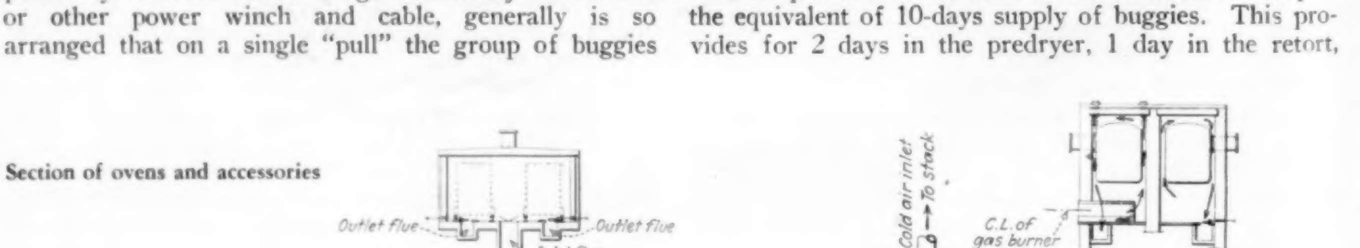
The pulling operation, which is usually done in small plants by a horse and in larger works by an electric or other power winch and cable, generally is so arranged that on a single "pull" the group of buggies in the retort and the groups in the several coolers are drawn simultaneously one stage forward. To accomplish this operation in a minimum time at a minimum of exposure and burning of the hot charcoal by the air requires the presence and teamwork of a large part of the entire plant force, often including all the wood loaders. Only when irregularities in the buggy track, most often caused by warping of the retort bottom, result in a derailment does this operation expose the charcoal more than one or two minutes to the air.

Charcoal as it leaves the retort hot requires not only cooling but also air conditioning to make it free from the tendency to spontaneous heating. Fresh charcoal when first exposed to the air adds on its surface huge quantities of atmospheric gases and moisture. This process of adsorption is exothermic and results in spontaneous heating with firing of the charcoal unless great care is exercised. Hence in the charcoal cooling yards and sheds it is essential always to have at least one man on duty giving close attention and frequent inspection to all of the buggies. It is vital that during this cooling period the charcoal be protected against rain as charcoal that has been wet fires very readily. It is usual that each shift in even the moderate-size plants include two charcoal watchers whose duties include not only inspection of the buggies but lubrication, handling by transfer car, delivery to the emptying tipple, and occasionally also minor repair work on cars.

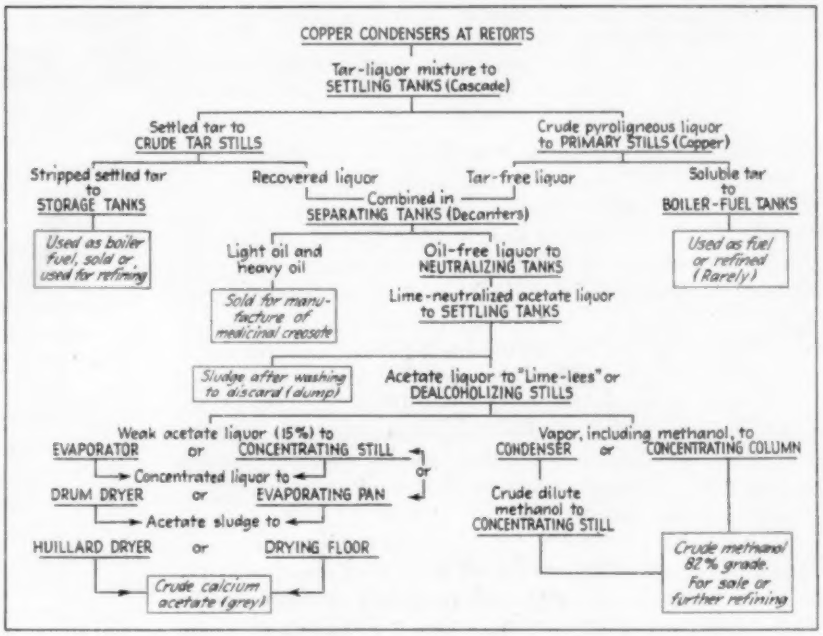
When the charcoal leaves the second cooler, it should not ignite in the air. Those who use a third cooler often allow the buggies to stand in it with the doors open merely to facilitate closing in of the charcoal and smothering out of fire in case of reheating and ignition. After the charcoal leaves the last cooler, it must under fire regulations stand two days in the buggies before emptying. Furthermore, after it is loaded into a freight car for shipment, the car must be held for an additional 24 hours with the doors open further to insure against fire during transportation.

Charcoal for a blast furnace is customarily hauled in the buggies immediately from the second cooler on to the fuel trestle of the furnace. In this case a buggy is in use only 5 or 6 days from the time it is loaded with wood until it is empty and ready to go back to the wood yard for reloading. Where the charcoal is shipped, a buggy is usually 8 to 9 days in use. Hence in most plants it is essential to have on hand in repair the equivalent of 10-days supply of buggies. This provides for 2 days in the predryer, 1 day in the retort,

Section of ovens and accessories



2 days in the coolers, 2 days holding charcoal, 1 day for discharge, inspection, and oiling and repair, and 2 days in the wood-loading yard.



A multitude of variations of this simple chemical flow sheet are used throughout the industry

Wood gas from a well-maintained retort installation is typically 53 per cent CO_2, 27 per cent CO, 15 per cent CH_4, 3 per cent unsaturated hydrocarbons, and 2 per cent oxygen and nitrogen, principally nitrogen. About 7,000 cu.ft. of such gas are produced per cord of wood treated. The heating value of the gas is approximately 275 B.t.u. per cubic foot. In only one plant is it known that any use other than retort fuel is being made of this gas. And in the single instance referred to, the utilization is at present decidedly in the experimental stage.

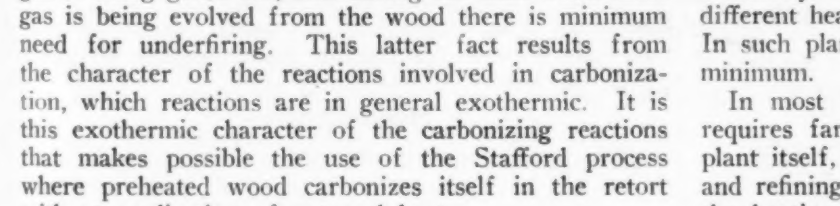
In most plants gas from the retorts is not collected in a common header but returns from the outlet of the condenser to be burned immediately under the retort from which it has come. Many rule-of-thumb firemen in the industry almost insist that this simple scheme be followed in order that they may use the size and character of the flame from the gas as a gage of conditions within the retort. The major disadvantage lies in the fact that during the period when the most heat is needed under the retort the smallest quantity of fuel gas is being given off; and during the time when most gas is being evolved from the wood there is minimum need for underfiring. This latter fact results from the character of the reactions involved in carbonization, which reactions are in general exothermic. It is this exothermic character of the carbonizing reactions that makes possible the use of the Stafford process where preheated wood carbonizes itself in the retort without application of external heat.

In a very few plants the gas from all the condensers is brought together in a header and is scrubbed for the recovery of alcohol and acetic acid vapor before it is redistributed in another header for retort fuel. In a few cases the gas is collected by the header and redistributed to the retorts where most needed without scrubbing. Gas scrubbing yields a small increase in acid recovery and a larger percentage increase in alcohol recovery. In one plant the alcohol so recovered is approximately one gallon of 82 per cent crude methanol per cord of wood processed, a 10 per cent increase in over-all yield.

Heat utilization about many wood-distillation plants is not closely supervised nor efficiently controlled. This is in large measure the result of having available large quantities of waste wood from saw mills and the feeling that fuel is a negligible item in total operating expense. In a few cases, however, managements have worked out extremely close control and efficient interlock of the different heating and power operations of the business. In such plants the net cost of the fuel is obviously a minimum.

In most instances programming of heat utilization requires far wider consideration than the carbonizing plant itself, and often even more than the carbonizing and refining units. In a considerable number of cases the heating and power system for efficiency must be interlocked with those of affiliated metallurgical works or sawmills. The way in which this interlock is accomplished is well illustrated by the splendidly organized scheme used at the Cadillac-Soo Lumber Co., Sault Ste. Marie, Mich. That plant includes a large sawmill, the wood distillation units, and a crude chemical plant, but not a refinery. In its operations the following plan is used:

(1) Sawdust and hogged wood waste is moved by air transport for both boiler firing and retort firing.
(2) The retort gas is burned under each retort individually.
(3) Steam from the boilers is used first to carry the heavy peaks of the sawmill load, such as bandsaws, wood hogs, etc., through a large steam engine.
(4) The engine exhaust steam is used in the still house and for heating the drum dryers used on calcium acetate.
(5) The boiler-flue gas is used in the Huillard dryers to the extent needed, the balance automatically venting up the main boiler stacks.
(6) Tar not required for sale or refining is used as boiler fuel.



(7) The predryers are heated with the products of combustion from the retort furnaces.
(8) A small amount of purchased power is used at a favorable load factor because the heavy peak loads are carried as above described.

Under this arrangement practically no purchased fuel is needed. This condition, however, is a result of the relatively high percentage of the total quantity of logs brought from the woods for lumber and the relatively small percentage for carbonization. Were this ratio changed materially the waste wood from the sawmill might not suffice to furnish all the heat and power of the carbonizing and chemical plants.

In a very large number of plants of the industry the installation of retorts has not been made in such a way as to conserve heat to the maximum degree. Hence in almost every case there is more than enough sensible heat in the products of combustion from the retorts to provide for predrying.

Treatment of Crude Liquor

Crude liquor as it leaves the retort house is a mixture of the condensed tar, oil, and aqueous solution of the chemicals produced. It is allowed to settle in large wooden tanks, generally with cascade decanting. The tar which settles to the bottom is then heated in a crude tar still to strip from it the dissolved and entrained acid and alcohol. The aqueous layer is treated in copper stills for the volatilization of the liquor, acid, and alcohol from the tars and oils which are dissolved in this water layer. The aqueous condensate from both crude tar stills and crude liquor stills is combined. The two types of tar recovered are kept separate unless both are to be used as boiler fuel. Usually only the "settled" tar is refined. In a very few instances the "soluble" tar is used for making certain creosote products; almost invariably it is used as boiler fuel.

The liquor freed from tar as above described is allowed to settle in order that the light and the heavy oils which separate from it may be decanted before further processing begins. The tar-free liquor may be treated in a wide variety of ways according to the plant facilities, the judgment of the management, and the variety of products to be made. Most commonly it is first neutralized with lime and then distilled in iron stills (lime lees). The vapor from this distillation may be condensed as crude dilute methanol which is subsequently concentrated; or it may be taken directly to a concentrating column from which the tailings water goes to waste and the concentrated crude methanol of 82 per cent grade is the product. Further refining of the methanol is a distinct operation.

Liquor From the Lime-lee Stills

Concentrated liquor from the lime-lee stills is a solution of calcium acetate containing about 15 per cent by weight. In the older type plant this is evaporated in open pans and then seeded down to form acetate sludge which is subsequently dried on the cement floors forming the top of the ovens. All more modern plants, including the older plants of larger capacity, use some form of evaporator and then run the concentrated liquor to a steam-heated drum dryer which forms a sludge. Then this is usually further treated in the Huillard dryer from which it comes dry and of a size ready for bagging and shipment. Occasionally the sludge from a drum dryer is "finished" on top of the ovens in the old-fashioned way.

Direct recovery of acetic acid is now practiced at seven plants of the industry which use a variety of processes. In most of these the liquor, after being freed from tar and alcohol, is exposed to some solvent for the acid. The solvent is forced in at the bottom of the stripping tower and broken up by baffles into small droplets which rise through the liquor. The liquor descends countercurrent fashion in order to accomplish maximum recovery. In Suida process plants the acid as vapor passes up through the solvent oil (see *Chem. & Met.*, July, 1932, p. 386).

The solvent and acid are separated by distillation and the recovered solvent returned to the process. The acid is then purified or shipped in a crude condition.

In the Suida process the solvent used is a high boiling oil from the tar; this process is used in two plants. One other southern plant uses the modified Melle process but has not disclosed what solvent it is employing. The other direct-process plants use ethyl ether as the solvent.

Refining of wood chemicals is a distinct operation which is carried out in only a limited number of plants, and only part of these are directly associated with the carbonizing works and crude plants. The equipment used for the chemical treatment, distillation, and fractionation in these refineries is of the most modern chemical-engineering type. Copper equipment is general; but for highly refined acid products, silver is also commonly used. In these refineries the major products made from the crude methanol are: 95–97 per cent methanol, pure methanol, denaturing-grade methanol, methyl acetone, and "allyl alcohol" (a fraction containing the allyl and higher alcohols).

Modernization

The appearance of pure synthetic methanol in large quantities as a competitive material has materially affected refinery practice. In general it has been found better to leave the pure market to the synthetic product and direct as much of the production as possible into the non-competitive denaturing grade. This phase of commodity competition will be more fully discussed in a succeeding article.

Modernization of some of the smaller and older plants of the industry might appear on casual investigation to be very much needed. Unquestionably, as favorable market conditions recur, there will be considerable such development. However, it should be borne in mind by engineers generally that the margin of profit in the manufacture of wood products by distillation is not large. Hence replacement of older and somewhat less efficient process equipment, which has been written off of the books during earlier profitable years, cannot always be justified. To permit new capital expenditures simply for replacement it is necessary to have available demonstrated markets, especially for the charcoal produced, which can be expected to insure capacity operation for a considerable time to come. It is particularly for this reason that one need not expect development of large new capacity in the industry. Gradual rebuilding and modernization undoubtedly will occur at existing plants partly, though not wholly, as a measure of maintenance and repair.

Gas Industry Discusses Technical Problems

EDITORIAL STAFF REPORT

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CHEMICAL ENGINEERING interest in the recent meeting of the American Gas Association held at Atlantic City, October 10–12, centered in the technical section dealing with distrbution, production, and chemical problems of the industry.

Transmission and distribution problems of the industry have assumed much larger importance because of the evident development of high-pressure, long-distance pipe lines. Although many of these pipe lines are owned and operated independent of city gas works the responsibility of gas engineers has extended to the new transmission questions; and from the technique of gas transmission the city division of the industry is borrowing numerous important developments. Particularly it is notable that surveys to determine corrosive conditions of the soil and the provision of proper protection for underground piping are now more widely recognized than ever before.

Soil Corrosion of Pipe Lines

On several previous occasions at gas association meetings reports have been given of surveys to determine the probable effect on new pipe lines of soil corrosion conditions. Apparently for the first time at Atlantic City there was a report on the use of such a soil survey, employing the Shepard soil-resistivity rods, for the inspection of soil conditions around an old pipe line. The results of this report by A. V. Smith, electrolysis engineer of the United Gas Improvement Co., related to a 12-in. steel main in Harrisburg, Pa. Soil resistivity tests were made to determine the points at which the old main probably required replacement. Subsequent uncovering of this main revealed conditions accurately forecast by this method, giving greatly strengthened evidence to the conclusion that the measurement of soil resistivity, if done close to the pipe line or close to the point at which pipe is to be installed, is a reliable means for determining probable rate of attack. The possibility of using this method in forecasting damage to chemical engineering structures is, of course, obvious.

Coating of Underground Pipe Lines

Coating of underground pipe lines exposed to abnormally corrosive soil is now recognized as essential. But the industry has held a wide variety of opinions as to the effectiveness of different types of coating. A subcommittee report on this subject by J. K. Crowell summarized the present available information. Seven of the conclusions that relate to the coating tests were expressed by the committee as follows:

The protective value of a coating depends primarily upon the nature of the coating and, to a minor extent, upon the soil.

When a coating fails, the pitting rate depends upon the soil.

The electrical conductance and pinhole tests are useful methods for determining the protective value of coatings.

The protective value of a coating is increased by increasing the thickness, within certain limits.

Mechanical distortion after application is the principal cause of bituminous coating failures.

Organic reinforcing materials are decomposed by bacteria and fungi in the soil and the extent of this decomposition or rotting depends upon the nature of the soil and upon the extent to which the materials are protected with bitumens or disinfectants.

Thin, or what might be termed paint, coatings do not add enough to the life of the pipe to justify their use.

Jointing of pipe has also been a subject of extended consideration including an elaboràte experimental investigation done at the A.G.A. testing laboratory in Cleveland. The history of joints, especially those of cast-iron pipes, was summarized in a paper by M. I. Mix of Chicago. This included a discussion of the different types of gasketed clamp joints as well as the performance of the rubber and the more recent development of welded joints. The research work reported by K. R. Knapp gave considerable emphasis to the importance of rubber gasket coupled joints, as, in general, the experimental work does not indicate that cement joints are satisfactory or that lead joints, either cast or caulked, are permanently tight except for very low pressure systems.

Preventing Gum Formation

Saturation of gas with both water and oil vapor to reduce the tendency for leakage in distributing systems is now generally practiced. The subcommittee responsible for investigation into this subject reported that the record of experience in a number of cities where dry natural gas was substituted for saturated manufactured gas proved the importance of water saturation and oil fogging.

Treatment of gas to prevent formation of gums in the distribution system is now recognized as important under many conditions. A fundamental research on the causes of gum formation was reported at the convention by W. H. Fulweiler who outlined the results of his laboratory studies showing that there are two distinct types of gum formed. When condensation of hydrocarbons takes place during distribution, a "liquid-phase" gum may be formed from styrene and indene. "The obvious remedy for this condition is to remove a sufficient amount of the indene and styrene normally present in the gas so that they will not condense out in the system." An entirely different type of gum is formed if the gas contains any oxides of nitrogen. This "vapor-phase" gum can be prevented by proper removal of the

nitrogen oxides in the plant, "and this can now be done commercially at very small expense." Rather acrimonious discussion of the commercial significance of this gum problem developed, but it was evident that there was general acceptance by engineers of the conclusion that two types of gum could form and that the prevention of trouble demanded attention to both under certain plant conditions.

Technical Developments of Gas Production

Technical developments dealing with the problems of gas production and the chemical aspects of the industry were not considered by the A.G.A. at a spring Production Conference as has been customary in recent years. Hence the presentation of all of the committee investigations and technical papers on this phase of the industry made the year's work available at Atlantic City for the first time. Since only a single convention session could be devoted to these problems, for which ordinarily six sessions are used at the Production Conference, mere skeleton outline of the year's work was given. All of the committee reports, including the technical papers prepared at committee request, are however available in preprints.

The Chemical Committee, as a summarization of new developments affecting the industry, had presented four papers of general chemical engineering interest. S. F. Smith and H. G. Rose of the Koppers Research Corp., presented a summary of scientific developments in the carbonization of coal. Lloyd Logan of Johns Hopkins University presented a lengthy paper on water-gas manufacture accompanied by an extremely elaborate bibliography, which covered not only theoretical and practical phases of water-gas making but also continuous production of water gas, chemical utilization of water gas, complete gasification of coal, and related subjects. A third report on gas purification by D. L. Jacobson and G. M. Carvlin of the Koppers Research Corp., discussed recent developments affecting sulphur removal and the preparation of certain byproducts made potentially available.

Dressing of Leather Diaphragms

Dressing of leather diaphragms for dry meters was the subject of the fourth review presented under the auspices of the Chemical Committee. Because of its general significance as affecting the behavior of leather in contact with various industrial materials, the conclusions expressed in this paper by L. M. Van der Pyl are of interest to leather men generally.

Potential new byproducts from gas making are commanding increased attention of the chemists of the industry. A report on ammonium thiocyanate recovery from ammonia liquor was made by Louis Shnidman of Rochester Gas & Electric Corp. About 2.5 grams of this chemical occurs per liter of ammonia liquor made in a typical coal-gas plant. Recently practicable means for commercial recovery have been developed and plant-scale operation of this process is actually going on. There appears to be an increasing demand for ammonium thiocyanate as a parent substance from which to make other cyanides, thiourea, textile mordants, and photographic chemicals. Shnidman's paper gives a full resumé of the chemical principles involved and describes briefly the commercial processes which have been proposed in the past.

Testing of coals as to their carbonization behavior is advanced one stage further by the fifth progress report of the subcommittee under the chairmanship of J. S. Haug, which has dealt with gas coke and byproduct-making properties of American coals. Accompanying this report is a summary of the properties of five coals, Nos. 16 to 20 in the series of 25 tested under the joint auspices of A.G.A. and the U. S. Bureau of Mines. It is concluded as a result of the investigation thus far that the new test procedure developed will yield results of definite commercial significance that can be interpreted for accurate forecasting of the behavior of a coal in any of the standard types of high-temperature carbonizing retorts or ovens.

Forecasting Further Development

Forecasting further developments of important byproducts and secondary derivatives of the present primary byproducts, A. R. Powell formulated a series of conclusions as to the trends which may be expected in these matters. His conclusions which follow have wide significance for those taking a long-time view ahead regarding any of the chemicals concerned:

Sulphur, obtained as a byproduct from the liquid purification of gas, has demonstrated its sales possibilities to a gratifying extent, despite the fact that it has been on the market for only two or three years. It is expected that this market will expand.

Ammonium thiocyanate is one of the newest special byproducts. Present demand is very restricted and it is impossible to predict future trends until present market and technical development programs have been carried further along.

Pyridine has all but passed out of the picture as a special byproduct of coal carbonization, due to the use of other denaturants for alcohol.

Creosote oil, the chief byproduct of tar distillation, has recently suffered a set-back in sales, due very largely to decreased construction activities. Future improvements in the market for creosote oil depend very largely on the resumption of construction work of all kinds making use of creosoted timbers, poles, ties, etc.

Pitch, although usually burned in large quantities as a fuel, has recently been exported in increasing quantities to Europe. Pitch has also found increasing utilization as a raw material for the manufacture of hard metallurgical coke of low ash and sulphur content, in byproduct coke ovens.

Carbolic oil, used in various disinfectants and antiseptics, has good future possibilities of increased markets. The present production, however, is considerably lower than 10 years ago, due to substitution of other ore-flotation reagents, which was one of the chief uses of carbolic oils at that time.

Phenol and cresylic acid, due very largely to the greatly extended uses for synthetic resins, have shown enormous gains in production and sales over the last ten years. During the same period, prices have decreased considerably, which is very favorable to further markets and uses for synthetic resins and plastics, and therefore to markets for phenol and cresylic acid.

Naphthalene production has shown a tendency to increase in the refined product, but there has been a slump in the domestic crude production, while imports of foreign crude have increased. Future markets for naphthalene are largely dependent on increased utilization in the synthetic chemical industry, such as increased production of certain dye intermediates and further development of the domestic production of tetralin, which is a solvent.

The coke-oven tar still is an interesting recent development in the processing of coal tar directly at the ovens, utilizing the sensible heat of the oven gases for distillation, followed by fractional condensation.

Coumarone resin, derived from certain light-oil fractions, has recently shown a promising tendency to widen its use in varnish and lacquer manufacture. Further technical developments in the preparation and use of this resin should lead to increased sales in the future.

Unemployment Problems In New York Area

By M. R. BHAGWAT
Volunteer Workers' Committee
Committee on Unemployment and Relief for Chemists and Chemical Engineers, New York, N. Y.

THE EMERGENCY unemployment committee in the Metropolitan New York area is engaged in assisting men in locating positions and in financially aiding those in distress. Plans are being carried out to extend the scope of assistance, and an appeal is being made for greater support from the more fortunate in the chemical industries.

The Committee on Unemployment and Relief for Chemists and Chemical Engineers was organized last winter by a few enthusiastic unemployed men in the profession. It is operating under the sponsorship of eleven technical societies in the greater metropolitan area. The organization is ably lead by Frank G. Breyer, chairman; Robert T. Baldwin, treasurer; and an advisory body consisting of thirty or more prominent leaders in the chemical field. The offices of the committees are located at 300 Madison Avenue, New York City, and are managed by Robert L. Holliday and M. R. Bhagwat.

The work began with a threefold purpose: first, to provide positions for qualified applicants who are registered with the committee. These positions may be in the regular chemical, temporary non-chemical, or temporary relief work. Second, to attempt to secure a proportionate share of funds devoted by city, state, federal or other charitable organizations and make them available for the registrants. Third, to raise funds through the aid of the chemical profession to carry on the work of assisting the needy cases among the applicants.

Unemployed men and women who are bona fide chemists or chemical engineers are registered and their records classified as regards their need and experience. The following figures show the registration and placements up to Nov. 1, 1932:

	Registered	Placed	Unplaced
Class A (most needy)	151	33	118
Class B	169	38	131
Class C	201	38	163
Class D	211	50	161
Total	732	159	573

Salaries earned by the registrants, as shown on their records, are as follows :

Range of former salaries	Registered	Placed	Unplaced
Over $5,000	81	17	64
$3,600-5,000	129	29	100
$2,400-3,600	179	55	124
Less than $2,400	343	58	285

During the early period of formation, the activities were mainly concentrated in registering and reporting needy cases to the Emergency Work Bureau of the Gibson Committee. Some help was secured. On March 4, a mass meeting was called where it was decided to approach the chemical profession for funds to carry on the work during the summer. Two letters of appeal—one in April, and another in June—were mailed to about 4,500 individuals in the metropolitan area. A third personal letter of appeal was sent by the chairman during the latter part of July to a selected list of 150. To these and other personal solicitations, only 658 responded with a total contribution to date of $9,552.52. Of these, several have contributed very generously.

The office space and furniture have been secured gratuitously, and a number of individuals have been devoting their time to the committee's work voluntarily. All the running expenses to date have been less than ten per cent of the funds received; the remainder is used for the direct aid of needy cases. Those receiving this help are rendering the following services:

(1) Approaching chemical organizations located in the metropolitan area with the view of securing jobs for the registrants. In this connection the gravity of the unemployment situation is emphasized as well as the need of retaining their present employees.

(2) Working in the institutions which are beneficial to the community at large, such as public libraries, community centers, and hospitals.

Thus far, those men soliciting for the committee have visited 3,045 small and large chemical organizations, and others have given valuable service to the public institutions mentioned above. With the available funds direct assistance has been given to only 19 cases. At present, due to depleted funds, there are only ten persons receiving aid, on an average of $12.50 per week, from the committee.

The need was increasing with the continued unemployment. It became necessary, therefore, to propose a program which would maintain the morale of the unemployed and promote the chemical research. The plan presented by the Volunteer Workers' Committee towards this direction can be briefly outlined as follows. It suggests securing funds by solicitation from the more fortunate members of the profession and chemical organizations sufficient to give an average of $25 per week, per needy case. The person receiving this will work under the direction of a chemical or chemical engineering department in a college or university located in the metropolitan area. The problems offered for his investigation will be strictly related to the development of fundamental science and must be of a non-competitive nature. It is estimated that an additional expense of $5 per week, per man will be sufficient to cover the cost of materials used. The space and direction will be supplied free of charge by the educational institutions.

Recently, it was decided to carry on the work of the committee through May, 1933, and a subcommittee was organized under the direction of George F. Hasslacher to raise funds to meet the present emergency. Thus far, there are not sufficient funds to launch the fundamental research program. It has been estimated that it is necessary to have $1,000 per individual selected to work in the university under this plan. Our maximum requirement is indicated by the needy cases shown above, but we must raise at least $50,000 to be of any definite assistance.

Another winter is approaching and the need is increasing every day. It is earnestly believed that combating the unemployment problem depends upon the action of the more fortunate members in the profession and their willingness to support the movement, either by financial aid or by giving men employment.

Combining Group and Unit Drives for Greatest Economy

By VICTOR A. HANSON

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PAINT MANUFACTURING, like most other industrial operations, requires a regular and systematic check on operating costs. Power-drive installation and maintenance and power-consumption costs make up a good portion of the operating expenses and should, therefore, be studied carefully.

First to be studied are the types of drive employed on the machines, as this has a direct bearing on the operating cost of each machine. In general, two types of drive are used, namely, group drive, in which a small group of machines is operated by one motor; and unit drive, in which an individual motor drives each machine. When properly applied each type of drive has its advantages. When improperly used, operating costs are boosted.

Modern group drives have several distinct advantages over other types of drive. By operating several machines in a group, a diversity factor may be used in determining the size of motor required, which permits a reduction in connected horsepower per machine with correspondingly low installation costs. This also makes it possible to load motors nearer to full capacity. The results are higher efficiencies and power factors and, at the same time, ample capacity for peak loads.

Unit drives have a definite application on machines of large individual load or machines which are remotely located and in which the installation cost of group drives or wide fluctuation in power load would more than offset the added operating costs of unit drive.

To study a plant for the most economical types of drive to employ, each machine must be considered. To adopt one type of drive throughout, merely because it is suitable for two or three machines, would be to disregard entirely the operating costs in the rest of the plant. Machines should then be studied in groups, taking into consideration the advisability of relocating machines to take advantage of the economies of group-drive operation.

If, after a preliminary study has been made, it is decided that unit drives should be used on certain machines, then actual cost comparisons should be made. Bearing in mind that motors of sufficient size to carry the peak loads must be used, the increased power consumption due to lower efficiencies when motors are partially loaded in average operation should be figured. Also the lower power factor of the motors when under-loaded should be computed, considering the effect of these motors, including their relative size and time in operation, on the total power factor.

Maintenance costs should then be included, being careful not to overlook the fact that small motors located in exposed positions require frequent cleaning and oiling if breakdowns are to be prevented. If, after relative installation, maintenance, and power cost figures have been computed, the unit-drive installation proves to have a lower total operating cost than group drive, then, and then only, should it be installed.

On machines which may be either group or unit driven, operating costs per unit of production will show a difference directly proportional to the difference in annual operating costs in the paint industry, for with a properly designed group drive, production is just as great and of as good quality as with unit drive.

To determine the operating costs of various types of drive, a study was made in the plant of the Hilo Varnish Co., Brooklyn, N. Y. This plant is new and when it was built recently, careful consideration was given to power transmission.

The machines driven include the following:

- 11—34 x 20-in. Lead mixers
- 1—36 x 24-in. Mixer
- 4—135-gal. Mixers
- 3—55 x 45-in. Oil mixers
- 1—1,200-gal. Varnish-oil mixer
- 1—1,000-gal. Varnish-oil mixer
- 3—20 x 16-in. Pony mixers
- 1—Turbo-mixer
- 2—30-in. Grinding mills
- 13—26-in. Grinding mills
- 2—20-in. Grinding mills
- 1—18-in. Grinding mill
- 1—14-in. Grinding mill
- 1—10-in. Grinding mill
- 1—6-in. Grinding mill
- 1—Ball mill
- 1—Centrifugal
- 1—Gum crusher
- 2—Special filters
- 12—Pumps
- 1—Barrel tumbler
- 1—Can-sealing machine
- 1—Labeling machine
- 1—Auto press
- 1—Unit press

All of the grinding mills and mixers, except the Turbo-mixer, are group driven. The pumps are infrequently operated and located at remote places and are, therefore, unit driven. For the same reason, most of the other machines which are not operated in the major

Table I—Comparison of Installation Costs of Group-Unit Combinations and Unit Drives Exclusively

Combination Groups and Unit Drives*: Motors Required	Horsepower	Cost, Dollars	Unit Drive on Each Machine*: Motors Required	Horsepower	Cost, Dollars
6	25	1,900.26	5	10	1,081.35
1	15	251.10	13	7½	2,569.32
2	10	432.54	23	5	2,621.31
6	5	683.82	12	3	1,142.88
9	3	857.16	4	2	335.60
3	2	251.70	2	1½	152.20
1	1½	76.10	2	1	143.50
1	1	71.75	3	¾	196.05
2	¾	130.70	3	½	195.81
2	½	130.54	1	¼	29.10
Totals		4,785.67			8,467.12
Wiring		3,480.98			6,366.62

Line-Shaft Installation and Belts: Length of Group Shaft, Feet	Connected Machines	Motor Horsepower	Cost, Dollars	Unit-Drive Installation Complete With Proper Speed Reduction
18	5	25	374.40	
18	5	25	374.40	
30	4	15	409.66	
21	4	25	343.32	
18	5	25	374.40	Connection of motors direct to machines with types of speed reduction equipment best suited to the requirements.
18	5	25	374.40	
18	5	25	374.40	
16	2	10	54.52	
45	7	10	506.91	
10	2	5	191.42	
Totals			3,377.83	2,566.49
Grand Totals			**11,644.48**	**17,400.23**

* Includes control equipment.

production processes, such as the centrifugal, ball mill, gum crusher, and so on, are unit driven.

On the larger grinding mills, short-center, concealed drives were desired as a result of the platforms necessary around the mills. To meet these requirements, all-chain group drives are employed. On both mixers and grinders, however, where the slightest degree of flexibility is required, such as machine mobility or change of operating speed, flat belt group drives are employed.

In studying the operating costs of this plant, first, it is necessary to compile the installation costs of the power drives as shown in Table I. To illustrate how the installation costs are increased by improper application of drives, this table also gives the installation costs when an individual motor is employed to drive each machine.

As shown, the present combination of group and unit drive required 33 motors, costing with control equipment, $4,785.67. A unit-drive installation would require 68 motors, costing with control equipment $8,467.12. The wiring for the present group and unit drive installation cost $3,480.98, compared with $6,366.62 to wire a unit-drive installation.

The cost of the line shafts, complete with belts, anti-friction bearing hangers, chains, and so on, as installed, was $3,377.83. To install the drives necessary to connect the individual motors to the machines if unit drive only had been employed would be $2,566.49. This latter figure does not include any alteration of machines or conversion costs, as only a comparison between two new installations was made, and no consideration was given to the conversion of the present equipment to unit drive, which would of course, cost considerably more.

These compilations give a total installation cost for the present combination of group and unit drives of $11,644.48, as against $17,400.23 if individual drives had been installed on each machine.

In studying the operating costs a similar comparison was made between the present combination of group and unit drive, and the exclusively unit-driven installation. The fixed charges, which include depreciation, interest, taxes and insurance, amount to $1,746.67 for the present installation as against $2,610.03 for the unit-drive installation. The maintenance cost for one year is $83.50 for the group drive and $458.50 for the unit drive. (Maintenance costs are largely the cleaning of motors.) The annual power consumption of the present installation is 138,800 kw.-hr., costing $4,470.40. Due to the lower efficiency of individual motors, 150,870 kw.-hr. would be consumed and the power factor would be reduced by a unit drive installation, increasing the annual power cost to $5,263.65 if a power-factor charge is included.

Thus, the annual operating cost of the present combination of group and unit drive is $6,300.57, but if the installation had been equipped with individual motors on each machine, the annual operating cost would be $8,332.18.

Therefore, it can be seen that lack of consideration of the proper types of drive employed may easily boost the operating costs considerably. Group drives when properly designed and installed materially reduce the operating costs.

The tests of Table II show an interesting comparison as to the power consumption costs of operating mixers individually and in groups of two, three and four mixers at one time. It is seen that the operating power cost per mixer, when operated in groups of four, is less than one-third the average power cost when mixers are operated individually. The tests were run on average batches and were in no way distorted by mixing unusual materials or quantities.

The complete study shows that a properly balanced combination of group and unit drive has a lower operating cost than any other type of drive, and that these economies are derived through: lower installation costs with resultant fixed charges; lower maintenance costs; and lower power costs due to motors operating at higher efficiencies and power factors.

Table II—Power Cost for Mixer Groups

Number of Mixers	Power Consumption, Kw.-Hr.	Power Cost per Mixed Hour, Dollars
1 Mixer 40 gal.	2.6	0.0837
1 Mixer 120 gal.	3.6	0.1159
2 Mixers 40 gal. 120 gal.	3.8	0.0612
3 Mixers 40 gal. 50 gal. 120 gal.	4.0	0.0429
4 Mixers 40 gal. 50 gal. 90 gal. 120 gal.	4.5	0.0362

Leatherboard May Absorb All Leather Scrap

By CHANDLER D. INGERSOLL
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IT HAS ALWAYS been one of the regrets of the leather industry that animals do not furnish hides uniform in shape, thickness and texture. These shortcomings are the cause of much waste, for the trimmings are largely valueless and the product is always limited by the size, shape and thickness of the original piece. In a previous article (*Chem. & Met.* **39,** 1932, p. 81) the writer outlined the past efforts that have been made to utilize the enormous annual waste pile of many thousand tons of leather scrap. Particular emphasis was directed toward the tough, fibrous structure of leather and the means of disentangling it by a shredding process developed in our laboratory.

The quality of these shredded fibers and their low cost immediately suggested their utilization in the reformation of a leather sheet that would retain sufficient of the qualities of the original leather to expand the market for genuine leatherboard and provide an adequate outlet for scrap leather. The study that followed this suggestion involved first a review of the history of leatherboard and leatherpaper production, which, it appears, goes back more than 100 years in Europe and over 60 years in the United States. In manufacturing the earlier board, the raw material was entirely leather, but later, cellulosic materials including rags, cord, rope, straw, jute, waste paper and wood pulp found their way into the mix in greater or lesser proportion, or even to the exclusion of leather. The term "leatherboard" remained, however, and today there are still cases where board so named admittedly contains no leather. Fortunately, the present tendency is to distinguish between "fiberboard" which contains no leather, and "genuine leatherboard" which is made from leather stock, generally to the amount of 50–80 per cent.

Interest in leatherboard today is apparently greater than ever before, judging both from the quantity produced and from the number of patents that have been issued since 1915. According to advices received from the Eastern Leatherboard Conference, the United States produces annually from 8,500 to 12,000 tons of genuine leatherboard and has plant capacity totaling in the neighborhood of 30,000 tons annually. As the average production of heavy leather scrap in the United States is about 50,000 tons per year, there would seem to be ample incentive for the development of more extensive markets for leatherboard. If it should become possible to incorporate into the product more of the qualities of the original leather, so that it would more nearly approach the usefulness of leather, this expanded market should be assured, especially in view of the lower price which favors the board as compared with virgin leather. The problem is one that should make a vigorous appeal to the student of industrial waste consumption and bring into clearer focus our goal of a balanced leather industry.

In the present study of genuine leatherboard, we have considered not only the differences in chemical and physical structure of the individual fiber from what is customarily encountered in the board industries, but we have also given thought to the internal architecture of a manufactured board as compared to that of the original leather. In the animal hide we find the fibrilles closely twisted into tight strands (the fibers) and the fibers, in turn, stranded into fiber bundles. The compact stranding of these elements is easily demonstrated microscopically, while by the same method it can be shown that, in leatherboard, the individual fibrilles composing each fiber have lost their original close stranding. This has long appeared to the writer to be the underlying cause of part of the shortcomings of leatherboard. In how far it may be overcome is still to be studied.

The chemical and physico-chemical factors met with in making leatherboard are fundamental to an appreciation of process requirements. Although a tremendous technology has grown up around the use of cellulose fibers

Most attractive of the methods for leatherboard production is the vacuum cylinder machine; below we see continuous formation of the board on the vacuum cylinder, and at the right, emergence of the finished board from the press rolls

in the making of paper and boards, the literature on the proper handling of leather fibers is less than meager. Hence we have had to content ourselves with a consideration of certain fundamentals which confirm our previous belief that a thorough fundamental coverage of the subject will be necessary in bringing the manufacturers of leatherboard to the sound technical position to which they are entitled. That such an investigation is warranted from a commercial point of view is entirely evident from even a casual inspection of the leatherboard field. Suffice it to say, the end in view is not doubling the leatherboard market, but multiplying it many times.

In board formation from the shredded fiber the methods thus far studied have been illuminating. They comprise the wet machine, the hydraulic press, the vacuum cylinder and the carding machine.

The first method is now general practice in the industry and has remained essentially the same for many years. In it the scrap leather, together with small percentages of paper stock, jute, etc., is reduced in a beater to a uniform pulp, the leather "nubs" separated out, and the stock reduced to approximately 1 per cent consistency. The sheet is then formed on an ordinary wet wheel, or screen modification of the same, and the boards dried, rolled and trimmed for the trade. The principle item of interest is the degree of handling efficiency which has been devised and dovetailed into this traditional and time-honored process. Of striking importance, however, is the fact that it still remains essentially a paper process, whereas leather pulp and vegetable paper and board stock are so fundamentally different that it is difficult to understand the rugged persistence of the straight papermaker's art in the manufacture of genuine leatherboard.

Use of the hydraulic press for board formation is quite worthy of notice as it permits a flexibility in board density and thickness not generally attainable by any other process. Although this method is perhaps slightly more expensive than the other processes, it is worth noting also that the use of molds allows the final shape of the piece to be made in the press and thus obviates the necessity of later trimming, stamping, or cutting.

From a process point of view the most attractive method was the vacuum cylinder which gives a continuous, endless sheet showing high strength and excellent texture. The shredded stock here used was hydrated and fed to the machine at about 1 per cent consistency. As was expected, freeness proved a major item of consideration, but since these initial runs were made, investigation has shown this factor to be partially if not entirely soluble.

In all, the genuine leatherboard industry stands today as a field that should be particularly attractive to both the technical man and industrialist alike. With its development will come a balancing of product and byproduct, and an increased demand for leather scrap which should mean higher prices for this waste when the demand approaches the supply. Such development seems an economic necessity for an industry now burdened, as is leather, with a disproportionately large waste pile.

▼ ▼ ▼

Calculating SO_2's Behavior Toward Water

By D. S. DAVIS

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CRITICAL study of the solubility of sulphur dioxide by Sherwood (*Ind. & Eng. Chem.*, 17, 745, 1925) has resulted in a compilation of the best concentration, temperature, and partial pressure data presented in tabular form and in the form of isotherms plotted on logarithmic paper. In either form it is somewhat difficult to interpolate the data rapidly and accurately and there appears to be need for equations relating the variables and for more convenient means of graphical representation.

It is the purpose of this paper to present such equations together with nomographic charts which enable their rapid and accurate solution and to offer a new method of calculating the approximate dissociation constant of sulphurous acid.

Table 1. — Accuracy of Solubility Calculations

Equation	Solubility, S	Temperature, Deg. C.	Percentage Deviation, $\pm$
1	1.5 to 200	0	1.2
1	1.5 to 150	10	0.7
1	5 to 75	20	2.6
2	5 to 75	20	1.6
2	5 to 50	30	1.4
2	7 to 15	40	5.7

In order to relate p, the partial pressure of SO_2 in mm. mercury over an aqueous solution, with c, the concentration of the solution in grams of SO_2 per liter of solution, Lewis has derived the equation

$$c = Hp + \sqrt{KHp}$$

where H and K are the Henry's Law and dissociation constants, respectively.

Sherwood's compilation deals with solubility, S, on the basis of grams of SO_2 per 1,000 grams of water; and since c and S are nearly equal (differing by but 1 per cent at $S = 10$ and by but 4 per cent at $S = 75$) the relationship between the solubility and partial pressure may be expressed by

$$S = mp + a\sqrt{p} \tag{1}$$

where m and a are functions of the temperature. Between 0 and 20 deg. C., m and a are given by the purely empirical equations,

$$m = e^{-0.03876\,t - 1.2825}$$

and

$$a = e^{-0.03372\,t - 0.3054}$$

where e is the base of natural logarithms.

Between 20 and 40 deg. C., the form:

$$S = mp + a \tag{2}$$

is more convenient than $S = mp + a\sqrt{p}$ and m and a are defined by the equation, $m = 0.13229 + 0.003422\,t - 0.00013912\,t^2$ and $a = 1.50 - 0.0147\,t$.

The agreement between calculated and actual values of the solubility is illustrated by Table 1.

Solution of equations (1) and (2) is best accomplished by means of the alignment charts, Fig. 1 and 2, which carry two solubility scales, one labeled S, for

solubilities in grams of SO_2 per 1,000 grams of water and the other labeled σ, for solubilities in grams of SO_2 per 1,000 grams of solution. The two scales are related by the equations

$$S = \frac{1{,}000\ \sigma}{1{,}000 - \sigma} \text{ and } \sigma = \frac{1{,}000\ S}{1{,}000 + S}$$

while the use of the nomographs is illustrated as follows:

Solubility Nomographs

Fig. 1, equation (1): How much sulphur dioxide will dissolve in one kilo of water at 10 deg. C. when the partial pressure of SO_2 is 500 mm. mercury? Connect 500 on the left *p*-scale with 10 on the right *t*-scale and project the line to meet the right *p*-scale at the point *A*. Connect 500 on the right *p*-scale with 10 on the left *t-scale* and project the line to meet the left *p*-scale at the point *B*. A line connecting *A* and *B* will cut the *S*-scale at 106 grams SO_2 per kilo of water and the σ-scale at 96 grams SO_2 per kilo of solution.

Fig. 2, equation (2): The partial pressure of SO_2 over an aqueous solution of sulphur dioxide is 400 mm. mercury at 23 deg. C. What is the concentration of the solution? A line connecting 400 on the *p*-scale with 23 on the *t*-scale cuts the solubility scales in the values $S = 56$ grams SO_2 per kilo of water and $\sigma = 53$ grams SO_2 per kilo of solution.

Table 2.—Calculated and Recorded Dissociation Values

Temp., deg. C.	0	5	10	15	20	25
Equation (3)	0.031	0.026	0.023	0.020	0.017	0.015*
Sherrill and Noyes	.....	.....	.....	.....	.....	0.015†
Kerp and Bauer	.....	.....	.....	.....	.....	0.017
Lindner	0.031	.....	.....	.....	0.020	0.017
Campbell and Maas	0.031	.....	.....	.....	0.020	0.017

*Calculated from equation (3) although this equation is intended for use only between 0 and 20 deg. C.

†Calculated from the ionization, λ, and the concentration, *c*, by use of the equation $K = \frac{\lambda^2 c}{1 - \lambda}$, not corrected for activation.

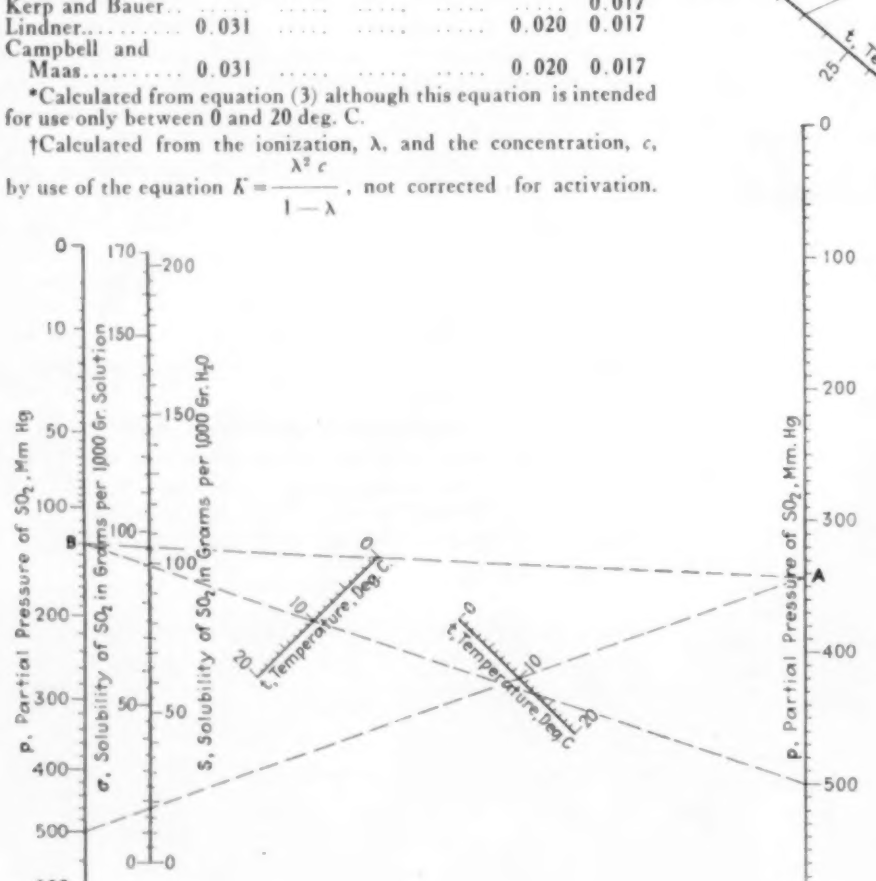
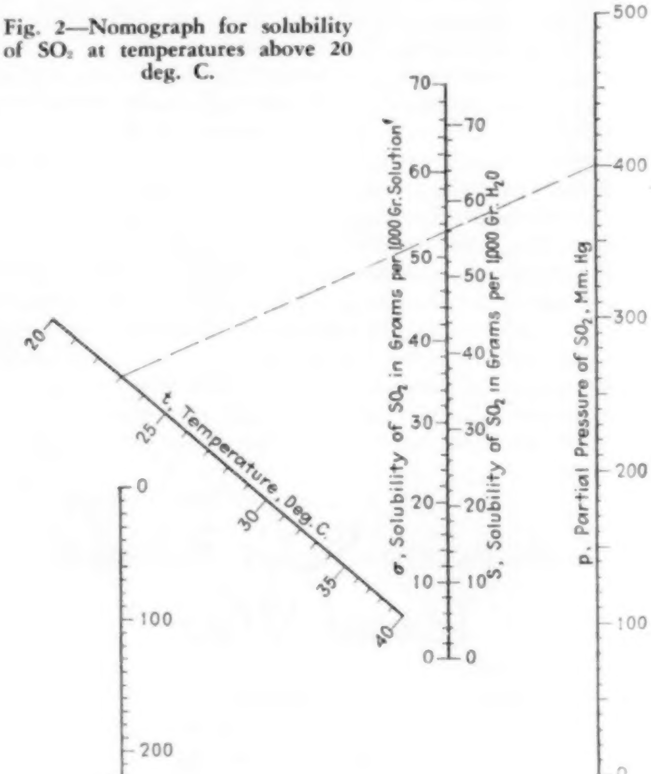


Fig. 1—Nomograph for solubility of SO_2 at temperatures below 20 deg. C.

Dissociation Constant of H_2SO_3

Comparison of the Lewis equation and equation (1) shows that the Henry's Law constant, *H*, is approximately equal to *m* and that $\sqrt{K H}$ is very nearly equal to *a* so that the dissociation constant of H_2SO_3, *K*, is practically equal to a^2/m. The dissociation constant is usually calculated from concentration data expressed in

Fig. 2—Nomograph for solubility of SO_2 at temperatures above 20 deg. C.



mols per liter rather than in grams per liter, making the final approximation $a^2/64m$ since the molecular weight of SO_2 is 64.

On substitution of $e^{-0.03372\, t\, -\, 0.3054}$ for *a* and of $e^{-0.03876\, t\, -\, 1.2825}$ for *m*, the dissociation constant may be expressed as a function of the temperature:

$$K = \frac{e^{-0.02868\, t\, +\, 0.6717}}{64} \qquad (3)$$

In Table 2 it is shown that the approximate values of *K* calculated from equation (3) are in line with values given by Sherrill and Noyes (*J. Am. Chem. Soc.*, 48, 1861, 1926), Kerp and Bauer (*Arb. kaiserl. Gesundheitsamt*, 26, 297, 1907), Lindner (*Monatsh.*, 33, 613, 1912), and Campbell and Maas (*Pulp & Paper Mag. Can.*, 29, 599, 1930).

INDUCTIVE ELECTRIC HEATING IN CHEMICAL PLANTS

By R. D. CENTER
Industrial Engineer
Buffalo, N. Y.

ALMOST every piece of chemical plant apparatus used for reaction purposes has to be heated, and where the temperatures involved are within the range of ordinary steam the problem is only one of sufficient boiler capacity. Vessels requiring higher temperatures are generally heated by some form of open flame; and in cases where the charge in the apparatus contains highly flammable material, this method of heating is a decided hazard.

When the vessel has a bottom outlet the hazard is increased. Again, even with no fire hazard existing, trouble from cracked or burnt bottoms may be encountered in cases of apparatus with no agitation. A rather extreme illustration of this can be cited in the case of a cast iron H acid fusion kettle which was oil fired and blew up at a time when the electric power went off. This left the kettle without agitation sufficiently long for the bottom to crack out by reason of local overheating.

Heating such pieces of apparatus by the inductive electric method is so simple and offers so many advantages that it is rather surprising not to find it in more general use. The method, of course, is applicable to iron and steel vessels only, but this is about the only limitation of significance unless it be one of power costs in the case of a small user having a high rate.

Since this type of inductive heating is but little known and is apt to be vaguely associated with resistance heating or even the more costly and difficult high frequency systems used by metallurgists, this article describes and illustrates the general arrangement of three installations. These are chosen as representative of cases commonly occurring in chemical plants of ordinary size. Together with several others they have been in operation for several years and have had ample opportunity to demonstrate their worth. It would be impossible to find a single individual in the plant who would give a thought to turning back to the old time method of heating these units.

The principle of this inductive heating is that of the step-down transformer so commonly used in the transformation of power line current, where a current in one coil generates, by magnetic action, an electrical current in another coil. A certain modification exists in the heating system, however, in that the second coil is omitted. The primary coil is wound around the outside of the

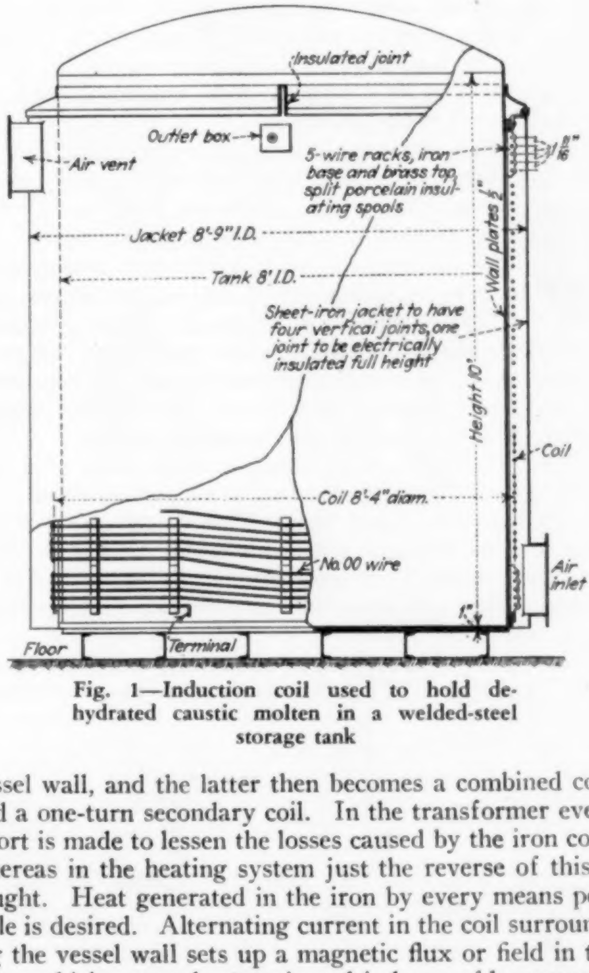


Fig. 1—Induction coil used to hold dehydrated caustic molten in a welded-steel storage tank

vessel wall, and the latter then becomes a combined core and a one-turn secondary coil. In the transformer every effort is made to lessen the losses caused by the iron core, whereas in the heating system just the reverse of this is sought. Heat generated in the iron by every means possible is desired. Alternating current in the coil surrounding the vessel wall sets up a magnetic flux or field in the latter which causes hysteresis and induces eddy currents. Owing to the extreme thickness of the metal these currents, which are a loss in the transformer, become intense and presumably join forces in flowing around the vessel wall at right angle to the path of flux. When these currents are great enough to be seriously resisted by the area of iron of the wall, the latter will be heated to high temperature and will, in turn, heat the contents of the vessel. Thus it will be seen that the heating is done only by induced currents in the vessel walls. The outside coil is in no sense a resistance and plays no part

except to conduct the primary current around the walls.

A high welded steel tank used as a storage for molten, dehydrated caustic is shown in Fig. 1. The hot liquid is sucked over into the tank from dehydration pots through electrically heated pipe lines. The heating requirements of this unit consist of holding the contents in the molten state. In other words, radiation losses only are to be overcome. Standard practice of maintaining temperature in this unit would be to mount the tank in a brick setting with either a coal grate, oil burner, or gas as heat source. Besides being bulky and having the usual maintenance ills of brick settings, the tank would be subject to periodic trouble from burned and buckled bottom plates, because there is no agitation in the tank and molten caustic is too sluggish to circulate freely.

All of these objectionable features are eliminated by the use of inductive electric heating. The coil, consisting of 50 turns of bare copper wire, is firmly held in insulating brackets supported against the walls of the tank and protected by an outer sheet steel jacket. The assembled unit occupies a space only about 8 in. greater in diameter than the tank itself. The power consumed by this unit amounts to 100 kw. and checks reasonably well with the calculated radiation losses.

Fig. 2 shows the application of an induction coil to a cast iron kettle of about 380 gal. capacity. The reaction in this unit calls for a temperature, as in the caustic tank, considerably beyond the reach of ordinary steam. The bulk of the charge consists of nitrobenzene and aniline which have to be brought to a boiling temperature and held through a period of refluxing. Since the nitrobenzene is highly inflammable, an open flame under the apparatus would create a serious hazard, as was proven by the many fires in days before the original oil-fired setting was replaced by the induction coil.

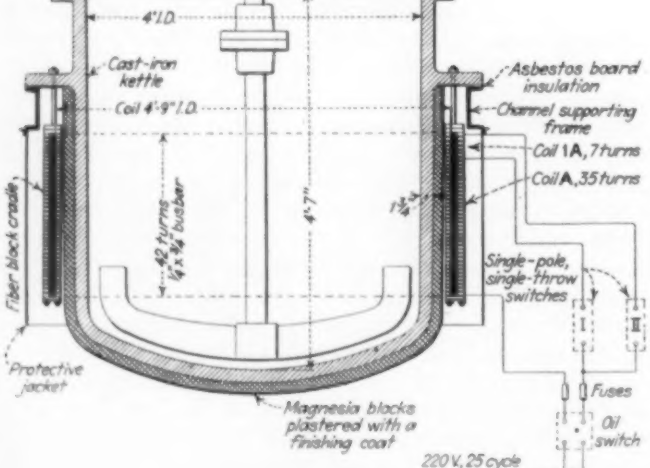
The coil for this unit consists of 42 turns of $\frac{1}{4}$ in. x $\frac{3}{4}$ in. copper busbar wound in a supporting cradle constructed of vulcanized fibre. This constitutes a removable unit to facilitate kettle renewals. Radiation losses are diminished by a magnesia block covering on the kettle. The coil is divided to give two heating stages, and at the higher with 35 turns in circuit the power consumption is about 40 kw.

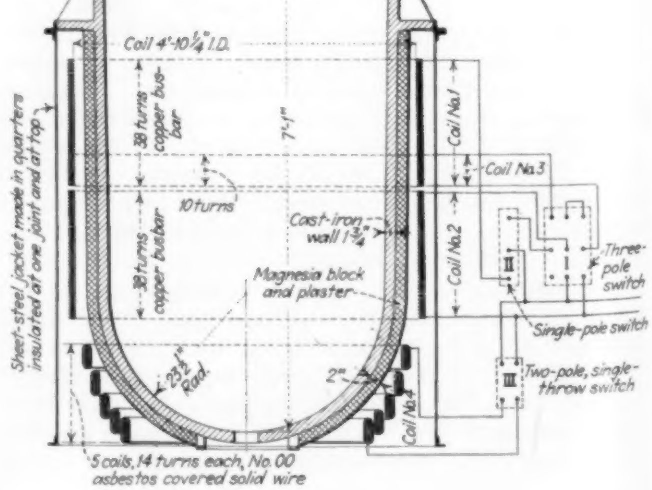
The adoption of inductive heating made it possible to locate this unit in an overcrowded floor space which under no circumstances would have held an oil-fired setting. This avoidance of placing the kettle in another department saved additional operating labor, the transportation of materials, and a long blow line subject to "freezing."

The induction coil applied to a deep cast iron still having a round bottom and a bottom outlet is shown in Fig. 3. A feature of this unit is that the charge slowly reduces in depth, and it is quite necessary to maintain temperature in the tailings to prevent solidification. If the main coil had been extended straight downward to surround the receding curvature of the bowl, it would have been quite ineffective owing to the large air gap created. Winding the lower portion of the main coil to conform to this curvature would have been simple enough in itself, but shaping the fibre support into this form was impracticable. This difficulty was overcome by winding a separate conical coil to fit around this curvature. This is wired to operate independently of the main coil. From the wiring diagram in Fig. 3 it will be seen that the main coil is so divided and connected through switches that four heating stages are possible. High heat is attained by operating the upper and lower halves of 38 turns each in parallel. Low heat is effected with these two halves in series. Intermediate stages are obtained by using the lower half coil alone or this same part in series with the lower 10 turns of the upper half.

The power input for this unit is about 63 kw. at high heat—when the two 38 turn coils are in parallel—and about 15 kw. at low heat with 76 turns in series. Omitting the details, a heat calculation shows that for a 7,600 lb. kettle and an average charge of about 2,800 lb. brought up 300 deg. F. approximately 490,000 B.t.u. would be required. Assuming an 80 per cent efficiency of heat generation, the 63 kw. would correspond to about 172,000 B.t.u. per hour and, therefore, a heating-up time of about $3\frac{3}{4}$ hours, which checks closely with practice.

Fig. 2—Application of an induction coil to a 380 gal. cast iron kettle. Fig. 3—Induction coil applied to a deep cast iron still having a round bottom and a bottom outlet





The current used in the primary coils of the foregoing installations is 25 cycle at 220 volts single phase. Current of 60 cycles or higher would give even better results, since induced currents vary directly with the alternations. The effect upon the power factor of the plant is an item but not serious enough to outweigh the many advantages of the use of the coils.

All of the foregoing will have emphasized the merits of this form of heating. The ease and speed of operation, the simplicity of construction, the small space required, the absence of auxiliary equipment, and the lessening or even elimination of fire hazard are all important features.

In the design and construction details of these heating systems an important point must never be overlooked; this is, that all of the parts will be within the alternating magnetic field of the coil. If they are electrical conductors, so fabricated and situated as to form closed circuits concentric to and parallel with the turns of the main coil, they also will have currents generated within them. The strength of such currents will be proportional to the density of the magnetic flux which they intercept. This is not difficult to overcome, but it is highly important to do so for damaging appearage may be developed in the least expected places. The steel jackets must all have a vertical, electrically insulated joint, somewhere in their circuit; the steel vessel supports must have a broken circuit as well as all other encircling structural members. Even the binding wire holding the magnesia covering must be in some form to preclude closed metallic circuits. This fact was disregarded by the coverers on one installation who used regulation woven wire to support the magnesia blocks. Shortly after the switches were closed for the first run, the wire melted and the insulation fell in a heap on the floor below.

Fortunately, the voltage induced in these parts, as in the kettle walls, is low—from 3 to 6 volts in the case of the still in Fig. 3—so that any of the ordinary non-conductors such as asbestos sheet packing will serve in insulating the joints. Welded connections are preferable to bolted or riveted ones on the surrounding steel, since scale or rust under such fastenings may insulate them if they are loosely driven and their induced currents may be great enough to bring them to a red heat. This action has actually been observed.

Unfortunately for the designer of an inductive heating system no extensive data have been developed relative to action of induced currents in the metals which he has to use. All development work by generator and transformer builders has been along the lines of producing iron cores and pole pieces which were least subject to formation of induced currents and consequent heating. It is known that magnetic flux action in iron is influenced by all such factors as hardness, chemical composition, density and shape, but these are all so indefinitely known in the case of thick castings and forgings found in kettle and autoclave walls that most of the calculation is based on assumption. In spite of this handicap surprisingly good results have been obtained in the application of these coils to heating autoclaves with walls 4 in. thick, kettles and tanks as illustrated above, comparatively thin walled cast iron enameled pots, and even $1\frac{1}{2}$ in. iron pipe.

The comparatively moderate heating, or rather temperature requirements of chemical plant apparatus, making possible the use of the current frequencies of ordinary power lines, greatly simplifies a problem which is embarrassing in a metallurgical plant. There, the same system can be used to melt metals, but frequencies of several thousand alternations per second are required to induce sufficiently disruptive currents, and this requires highly special and expensive auxiliary equipment.

SAFETY IN CHEMICAL PUMPS

THOSE familiar with chemical operations are familiar with the continued troubles experienced with loss and damage due to leakage, corrosion, and breakage of chemical pumps, James C. Lawrence, chemical engineering, E. I. du Pont de Nemours & Co., told those attending the recent meeting of the chemical section, National Safety Congress. His idea of "safety" in this connection is the prevention of direct accidents to men from such pump troubles and the prevention as well of accidents caused indirectly by leakage, corrosion, and breakage.

Knowing the tremendous number of pump repairs, replacement of parts, and renewals, his assumption was, on undertaking the study, that the accident list would be large in some proportion to the number of breakdowns of chemical pumps—not necessarily large in severity but of rather high frequency. He was much surprised on obtaining records of the du Pont company's operating plants to find that probably chemical pumps are the safest class of chemical equipment used by the company. He has found on record only one major accident, one submajor, and five minor accidents due to chemical pumps.

He feels that everyone in the chemical section will agree that pumps to the operating man are a nuisance and a bugbear. This is primarily true, of course, because pumps require man's attention and hence are subject to man's inattention. The ideal pump is the foolproof pump.

As a result of the investigation Lawrence found that:

1. The greatest hazards to be overcome in chemical pumps are from ordinary leaks at stuffing boxes and gaskets, and breakage from corroded or weakened casings.
2. The number of actual injuries due to accidents or breakdown of chemical pumping equipment is probably low, but the potential hazard is always present on the normal unprotected pump.
3. The continual damage and loss to industry in equipment, time, and material is extremely high when considered as a total.
4. Most chemical pumping problems can readily be made reasonably safe from leakage and breakage hazards by using submerged pumps or pumps having no gland against the liquid head.
5. Other pumps should be provided with properly protected glands and casings, water-cooled stuffing boxes, and where, advisable, isolated from the operating area.

BOOKSHELF

An Explosive Review and Rejoinder

EXPLOSIVES, Vol. III. By *Arthur Marshall*. P. Blakiston's Sons & Co., Inc. 286 pages. Price, $10.

Reviewed by *E. M. Symmes*

MARSHALL is to be congratulated on bringing his well-known work on explosives up to 1932, but we cannot agree, for example, on page 36, in speaking of nitrocellulose lacquers, that wood cellulose is generally used, after being boiled thoroughly with soda under pressure to make the solution of nitrocellulose thinner. In this country at least, and we believe also in England, wood cellulose is not used and the nitrocellulose is not boiled with soda, but is heated under pressure with water alone to reduce the viscosity.

On page 39 Marshall speaks of the invention by the Germans early in the war of mixing 20-25 per cent sugar with glycerin, then nitrating the mixture to use in explosives. While the Germans may have done so, to the writer's personal knowledge this was being done at Kenvil in 1912, and contrary to Marshall there was no "considerable loss of nitric acid during nitration due to oxidation of sugar." Records in this office will disprove this point.

On page 42 Marshall speaks of "dimethylene glycol" and gives the formula, but throughout the rest of the book he refers to the same compound as "glycol" or "ethylene glycol" and in connection with the latter shows the same formula.

On page 46 great stress is laid upon the recent use by the Nobel Co. of low-freezing dynamites containing some nitropolyglycerin, which is stated to be comparatively expensive and insensitive. It was hardly fair to let this statement go unchallenged because since 1911 this low-freezing dynamite has been in constant use in the United States. The cost of polyglycerin is only very slightly higher than glycerin, from which it is made by mere heating.

In spite of the relatively enormous use of bulky or low density dynamites in the United States and the economy in the use thereof, this subject is absolutely ignored by Marshall.

An interesting and useful contribution by Marshall is the wealth of dynamite formulæ now shown for representative explosives in the various countries. The severity of the English test for permitted explosives is evident from the large amount of sodium chloride, or the like, in the composition. Probably for the first time, fairly representative compositions of the five broad classes of American dynamites are shown, although the information is rather meager on permissibles.

THE AUTHOR REPLIES

I am interested to know that mixtures of sugar and glycerine have been nitrated successfully without much loss of nitric acid. I could hardly be expected to know of results recorded in the office of the Hercules Powder Co. Naoum states that there was loss of nitric acid.

Reference to page 46 of my book will show that I did not lay "great stress" upon the "recent use" of nitropolyglycerin by the Nobel Co. I merely reviewed very briefly the general practice in former years in three countries. For that in the United States I relied on statements made in publications of the Bureau of Mines.

The use of dynamites of low density appears only to have become common in Great Britain since that portion of my book was written. It is interesting, but not surprising that these have been developed earlier in America, as we are inclined to be conservative about such matters. Not much about this has appeared in the technical press.

Mr. Symmes is no doubt correct in thinking that the English tests for Permitted Explosives have in the past been too stringent. Reference to the top of page 187 will show that the English official view agrees with his.

I am aware of course that the information about American "Permissibles" is rather meager, but unfortunately the compositions of them are not published, although this is done in the principal European countries.

A. MARSHALL.

Coking Practice Here and Abroad

INTERNATIONAL HANDBOOK OF THE BYPRODUCT COKE INDUSTRY. By *Prof. Dr. W. Gluud;* American edition by D. L. *Jacobson*. Chemical Catalog Co., Inc., 419 4th Ave., New York. 880 pages. Price, $15.

Reviewed by *F. D. Lohr*

FOR YEARS the developments in the byproduct coke industry have been so numerous and rapid that the technical literature of the art has not been able to keep pace with them. Business conditions for the past two years resulting, as they have, in a temporary recession in all lines have at least given the literature an opportunity to catch up with the industry. This it has done in a splendid way in the International Handbook, the American Edition of which is now being presented.

The German Edition of this handbook was first brought out in 1927 and 1928, and attempted to give a comprehensive survey of the outstanding achievements in the industry, in Germany as well as in the other countries where the byproduct coke industry has developed. It was realized that this first handbook was only a start and it was felt that a truly authoritative and international work could only be prepared through the cooperation and collaboration of competent technologists in the other countries interested, such as England, France and the United States. Accordingly, the original text was brought up to date and sent to America for revision. The staff of the Koppers Co., and particularly D. L. Jacobson up to the time of his death, revised it to include the latest American developments in oven and byproduct practice. It was then further revised in England by competent engineers and finally in Germany by Drs. Gluud and G. Schneider. This procedure has resulted in a book truly international in scope and authoritative as to subject matter.

The first section of the book is scientific in character and deals principally with the history, classification and properties of coal. The chapter on classification is especially valuable, bringing together as it does the latest theories of the leading scientists in Germany, England, and America on this important phase of the coal problem.

The second section of the book covers the applied technology of the byproduct coke industry. Descriptions of the latest plants for treating, washing, preparing, and handling coking coals are given. These are followed by the history and description of the types of coke ovens now in operation in America and Europe. These chapters also include information on oven accessories, such as charging machines, door machines, and self-sealing doors. The products obtained in the carbonization process are next discussed in detail. Typical chapters are those covering the subjects of coal gas, the removal of hydrogen sulphide, ammonia recovery, benzol and tar distillation. A final chapter has been included on plant measuring instruments, such as pyrometers, calorimeters and meters.

The book is broad in its scope and with few exceptions has missed but little of general value. The chapter on coke might well have included more material on coke for domestic furnaces, since the growth of this market has been an outstanding development in America in the last few years. The American Gas Association has published a number of reports in connection with carbonization

problems which might have been drawn on for further data in connection with certain other subjects in the book.

The work is one which should be valuable as a reference for teacher and student, and even more valuable to the man actually at work in the industry, who must keep in touch with what other operators are doing at home and abroad.

Industrial Instrumentation

The Manual of Instrumentation, Vol. I, Fundamentals of Instrumentation; Vol. II, Handbook of Industrial Temperature Measurement and Control. By *M. F. Béhar.* Instruments Publishing Co., Pittsburgh, Pa. Vol. I, 109 pages, price, $2; Vol. II, 320 pages, price, $4.

Reviewed by *T. R. Olive*

"INDUSTRIAL instrumentation," the science of applying mechanisms for the measurement, recording and control of industrial variables, has received but scanty place in engineering literature in recent years, aside from the publications of manufacturers and occasional articles in the technical press. With the increasingly greater reliance that industry is putting in "robot" control, it is fortunate that Mr. Béhar has undertaken the task of interpreting the trends and recording the state of the science as it is developing today in the United States.

The two volumes listed above are the first pair of a complete manual which has been appearing serially in the magazine *Instruments.* Parts of the manual to be later published in book form include sections devoted to the measurement and control of pressure, time and speed, flow, electricity, and a miscellaneous group which concerns liquid level, chemical conditions, radiant energy, chemical and physical properties, composition, simple magnitudes and quantities, vibration, and finally, acoustics.

As the author states in his preface, his aim has been the writing of a manual for the production man in industry, for in the last analysis, industrial instruments are primarily aids to production. In the main, this end seems to have been attained, although the objection may be raised that much of the theory transcends the needs of the ordinary instrument user. Particularly is this true of Vol. I, although it cannot be denied that the reader who will devote the necessary study to the theoretical passages will benefit through greatly increased understanding of the complexities of instrumentation. Vol. II appears to the reviewer to be more intensely practical. It will, in fact, stand on its own feet, without reference to the earlier volume, in meeting the needs of many instrument users whose concern is more with the types and limitations of temperature and humidity instruments than with the finer points of measurement and control theory. In this former the second volume is well qualified for it covers a singularly broad field in fairly compact manner.

It should not be inferred that Vol. I is entirely beyond the need of the casual user. The author's interesting instrumentation philosophy, as it appears throughout the volume, casts a new light on the subject. His dissertations on parts of controllers, measurable properties and modes of control, seem particularly apt. For those in charge of plant instruments, the section on "The Plant Instrument Department" is well worth the reading.

All in all, if any adverse criticism is to be given, it is that in seeking to make himself clear, Mr. Béhar has sometimes lapsed into a wordiness that is difficult to follow. Against this, however, may be set the fact that the material has been revised to a late 1932 basis which doubtless explains many of the departures from greatest clarity.

Burrell Sees Russia

An American Engineer Looks at Russia. By *George A. Burrell.* The Stratford Co., Boston, Mass. 324 pages. Price, $2.50.

Reviewed by *S. D. Kirkpatrick*

COLONEL BURRELL has written an intensely interesting book, but quite a different one than I had expected. Instead of a detailed engineering report, with the usual drab compilation of facts and figures, he has taken the broadest possible view in his observations and has written a most human account of the year and a half he spent in Russia under contract to help in the modernization of a part of the Soviet petroleum industry. Mrs. Burrell accompanied him and undoubtedly shared in the broad interest reflected in the several chapters on the social aspects of Russian life. The chapters on "Religion," "Morals," and "Women" are among the most interesting in this book.

Much less attention has been given to the industrial and political aspects but Colonel Burrell has not neglected them, nor has he been carried away by the propaganda and enthusiasm that often accompany such discussions of this great socialistic experiment. He evidently made a more intensive study of the educational programs and methods than most of our engineers who have served as technical experts. Perhaps it was his disappointment in working with some of the recent products of Russian schools that caused him to take a hand himself in the teaching process whenever opportunity afforded. Mass education lacks something that may, in the end, have the determining influence on the final outcome of the Bolshevik experiment. Colonel Burrell's book is not a highly polished literary gem, nor a studied philosophical treatise. This reviewer feels, however, that it is the best book that has come out of Russia as a result of the participation of American engineers in the technical affairs of the Soviets.

U. S. Chemical Patents, 1915-24

Chemical Patent Index (U. S. 1915-24). Vol. II. By *Edward Chauncey Worden.* The Chemical Catalog Co., Inc., New York. 1,190 pages. Price, $25.

Reviewed by *B. H. Strom*

THIS IS the second of a set of five volumes constituting an index to the chemical patents of the United States for the ten-year period 1915-24. It embraces a total of 188,400 patent citations covering the subjects under letters C, D, and E. The system of classification is the same as used in Volume One, in which was compiled the entire list of names of inventors for the period, and the index of subjects beginning with the letters A and B. In preparing the book a careful examination has been made of all patents listed in the Official Patent Gazette; those containing anything of chemical nature have been indexed with sufficient completeness and fullness to cover apparently all of the chemical subject matter from any angle which may be sought, each item being handled separately.

The index not only includes the patents for chemical processes and products, but also the uses to which these products are put. A total of 22,882 patents has been indexed, together with the reissues published during the period, covering the whole field of inorganic and organic chemistry, and chemical processes applied to biology, microscopy, botany, mineralogy, pharmacy, medicine, photography, and dyestuffs.

A handbook of this type should furnish a real stimulus to chemical invention and should minimize useless litigation based on faulty and inadequate information. The precise state of the patent art for any subject may be ascertained at almost a glance, eliminating laborious and often unsatisfactory methods of search. When Dr. Worden and his associates complete this monumental work they will have made an outstanding contribution to the reference literature of the world. American chemists and engineers are already deeply indebted to them.

The Metals, Their Alloys, Amalgams and Compounds. By *A. Frederick Collins.* D. Appleton & Co., New York. 310 pages. Price, $2.

THE author has added a book on metals to his already long list of 60 or more, which include "The Amateur Chemist," "Experimental Chemistry" and "How to Understand Chemistry." In his latest treatise he has attempted to interest the

youth in the early history, origin, occurrence, mining and uses of the metals. In very simple language the chemical and physical properties have been described. Under the head of uses of metals the most important compounds and their properties are mentioned. Not only are the common metals discussed, but the uncommon rare earth, radioactive, and "hypothetical" metals.

A.I.M.E. Series

UNDER the Seeley Mudd fund of the American Institute of Mining and Metallurgical Engineers, the following set was published by the McGraw-Hill Book Co. to afford younger men in the engineering profession some substitute for the broad contacts their predecessors had in their formative years. Each junior member of the society is to be presented with a set of the books. The price of the set is $12.50 and consists of five volumes.

CHOICE OF METHODS IN MINING AND METALLURGY. A record of experience in making engineering decisions. Price $2.50.

A HISTORY OF AMERICAN MINING. By *T. A. Rickard.* Price $3.

MINERAL ECONOMICS. Lectures under the auspices of the Brookings Institution, edited by *F. G. Tryon* and *E. C. Eckel.* Price $2.50.

EXAMINATION OF PROSPECTS. Second Edition. By the late *C. Godfrey Gunther.* Revised by *Russell C. Fleming.* Price $2.50.

TECHNICAL WRITING. Third Edition. By *T. A. Rickard.* Included by permission of original publishers, John Wiley & Sons. Price $2.

Two Valuable Society Publications

TRANSACTIONS OF THE AMERICAN INSTITUTE OF CHEMICAL ENGINEERS. Vol. XXVII, 1931. D. Van Nostrand Co., Inc., New York, N. Y. 425 pages. Price, $6.

MANY IMPORTANT subjects are treated in this volume. The first seven papers, totaling 122 pages, contain the symposium on stream pollution, presented at last December's meeting at Atlantic City. Of great interest is also the lengthy discussion of A. P. Thompson's controversial paper, "Platinum vs. Vanadium Pentoxide as Catalysts for Sulphuric Acid Manufacture," presented at the same meeting. This discussion is published for the first time in this volume.

Four papers are devoted to heat transmission and drying. A valuable contribution in the field of education is the four papers, with foreword by Dr. H. C. Parmelee, presented at the Ann Arbor Conference on Chemical Engineering Education, held in July, 1931. The recent statement of the Institute's Committee on Chemical Engineering Education in regard to the accrediting of educational institutions is also included. This volume of the Institute's Transactions represents a valuable contribution to the chemical engineering literature of the United States.

TEN-YEAR INDEX OF THE TRANSACTIONS OF THE ELECTROCHEMICAL SOCIETY. Covering Vols. 41-60 (1922-31). Secretary's Office, Columbia University, New York, N. Y. Price, $2.50. (20 per cent discount prior to Jan. 15, 1933.)

THIS INDEX is a complete survey of the progress made in electrochemistry during the last decade; the subjects of electrolytic refining and electroplating are completely covered, and every paper of importance in the electrochemistry of gases, which appeared during the period, has been catalogued.

Reference Works

REVIEW OF WORLD PRODUCTION 1925-31. 159 pages. Price, $1.25. Review of World Trade 1930. 68 pages. Price, $0.60. International Trade Statistics 1930 (including provisional summary figures for 1931). 369 pages. Price, $2.50. Balance of Payments of 1930 (including an analysis of capital movements in 1931). 183 pages. Price, $1.50. Statistical Year-Book of the League of Nations 1931-32. 342 pages. Price, $3.

THIS reference work, issued by League of Nations, at Geneva, Switzerland, is obtainable in the United States from the World Peace Foundation, in Boston, Mass. Text and tables appear in French and English throughout the volumes.

DIE UNTERSUCHUNG DER BRENNSTOFFE UND IHRE RECHNERISCHE VERWERTUNG. By *M. Dolch.* Verlag Wilhelm Knapp, Halle (Saale), Germany. 236 pages. Price, 19.80 RM.—The author, who died soon after completing this work, was one of the leading Continental authorities on coal technology. As the title indicates, he here presents the methods for coal inspection and testing, and then proceeds into a long discussion of the mathematic consequences and evaluations of these tests.

CHEMICAL ANALYSIS BY X-RAY AND ITS APPLICATION. By *Georg von Hevesy.* McGraw-Hill Book Company, Inc., New York. 333 pages. Price $3.—This latest of the George Fisher Baker non-resident lectureships in chemistry at the Cornell University, contains more than the title indicates; in addition there is an extended section on hafnium, and another on the abundance of the elements in the earth.

ORGANIC CHEMISTRY. By *G. Elbert Hill* and *Louise Kelley.* P. Blakiston's Son & Co., Inc., Philadelphia. 564 pages. Price $3.—The authors are professors at Wesleyan University and Goucher College respectively.

PHYSICAL CHEMISTRY, An Introductory Course. By *Worth Huff Rodebush* and *Esther Kittredge Rodebush.* D. Van Nostrand Company, Inc., New York. 421 pages. Price $3.75.—This new text originates in the atmosphere of Illinois, where Dr. Rodebush is professor.

FUNDAMENTALS OF PHYSICAL CHEMISTRY. By *Earl C. H. Davies.* P. Blakiston's Son & Co., Inc., Philadelphia. 365 pages. Price $2.75.—Another new text, originating from West Virginia University.

APPLIED COLLOID CHEMISTRY. By *Wilder D. Bancroft.* McGraw-Hill Book Co., New York. Third Edition. 544 pages. Price $4—The resourceful author has brought to date a text which has been successfully applied since its first edition in 1920.

THE MINERAL INDUSTRY DURING 1931, Vol. XL. Edited by *G. A. Roush.* McGraw-Hill Book Co., New York. 735 pages. Price $12.—This year's contribution to the traditional series, most of the contributors continuing their previous assignments.

PETROLEUM DEVELOPMENT AND TECHNOLOGY, 1932. Published by Petroleum Division of American Institute of Mining and Metallurgical Engineers, New York. 506 pages.—The trend in this annual series is noticeably to the oil-field practice.

GLASGOW AND THE CLYDE. Development Board for Glasgow and District, 27 St. Vincent St., Glasgow, Scotland. 63 pages.—A well published and illustrated book on the advantages of Great Britain's second metropolis as an industrial site.

T.A.P.P.I. CONVENTION PAPERS AND PROCEEDINGS, 1931-32. Published by Technical Association of the Pulp and Paper Industry, New York. 380 pages. Price, $5.—Proceedings and papers of the meeting held in February, 1932, including sectional meetings.

AN INTRODUCTION TO CHEMISTRY. By *John Arrend Timm.* 2nd edition. McGraw-Hill Book Company, New York. 553 pages. Price, $3.50.—Despite its comparative difficulty and an amateurish set of photographic cuts, this pandemic text is a commendably complete and well-assembled course in chemistry for non-specialists.

QUANTITATIVE ANALYSIS.—By *Edward G. Mahin.* 4th edition. McGraw-Hill Book Company, New York. 623 pages. Price, $4.—Detailed revision of the third edition published eight years ago.

ESSENTIALS OF COLLEGE CHEMISTRY. By *B. Smith Hopkins.* D. C. Heath & Company, New York. 544 pages. Price, $3.24.—A new text stressing the fundamentals of the entire range of chemistry rather than detailed ramifications of special subjects.

PLANT NOTEBOOK

Nomographs for the Calculation of Air and Gas Velocity

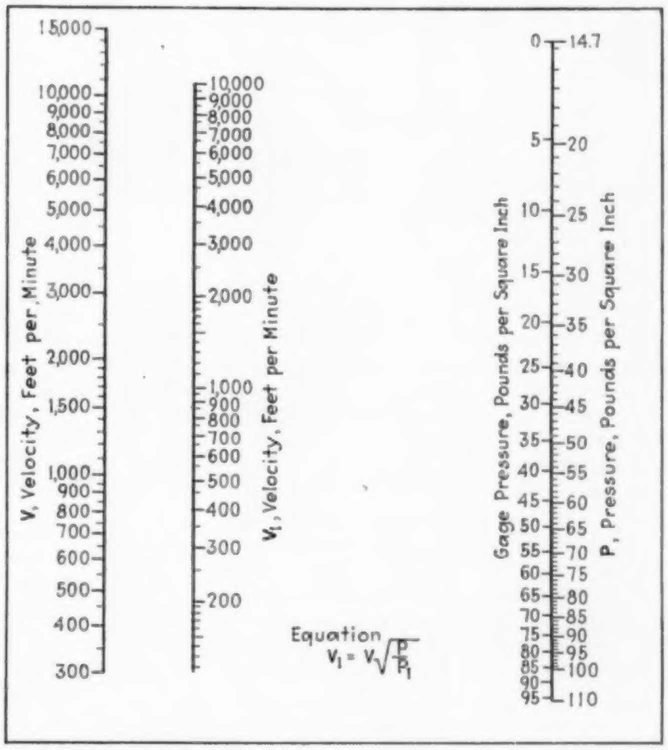
By A. Alison
Streatham, England

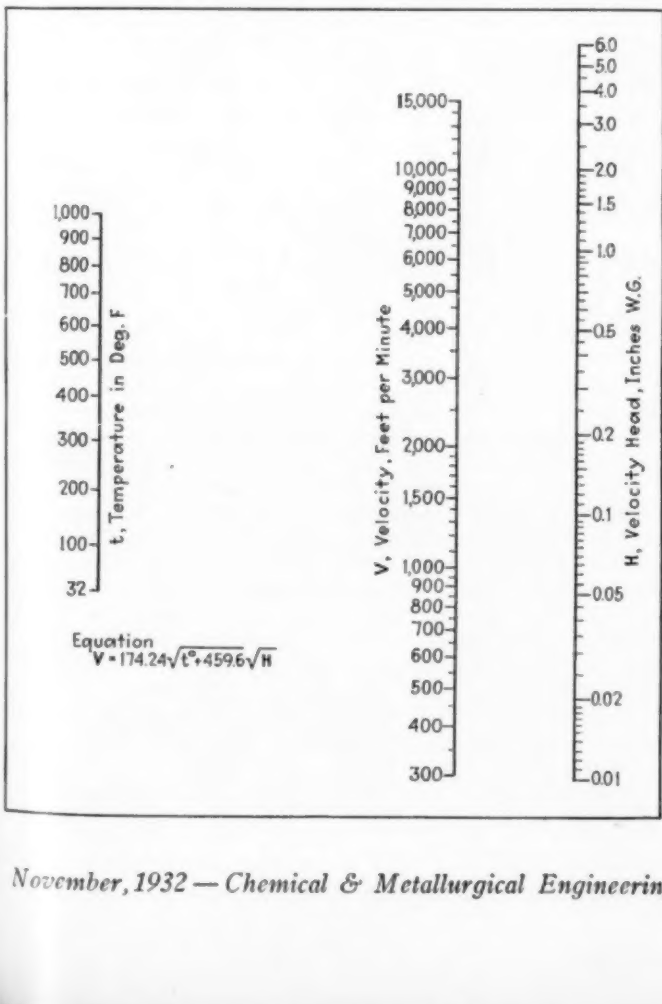
ALTHOUGH the calculation of the velocity (and hence, of the volume) of gases flowing in a duct is not particularly arduous, it is convenient to be able to reduce the operation to the simple use of nomographs when any considerable number of calculations are to be made. The method described here requires the measurement of the velocity head in inches w.g., using a Pitot tube, together with the measurement of the temperature of the gas in degrees F. and its specific gravity relative to air, if a gas other than air is to be measured. In calculating the volume of gas flowing, it should be noted that the mean velocity should be used. For this purpose, the velocity head to be measured by the Pitot

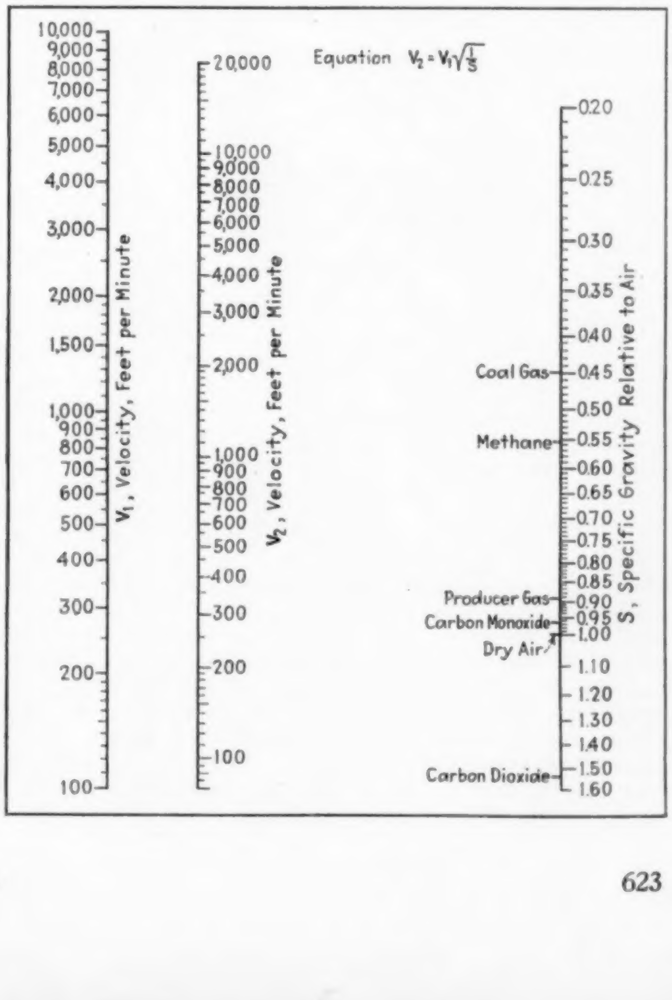
Fig. 1, Below—Nomograph for air at or near atmospheric pressure

Fig. 2, Upper Right—Nomograph for correcting air flow for pressures considerably above atmospheric

Fig. 3, Lower Right—Nomograph for determining velocity of gases of specific gravity differing from air







Values for Plotting Nomographs to Larger Scale

The first column of numbers in each group represents the magnitudes plotted on the individual scales of the nomographs. The second column represents the vertical distances in inches of each point above an X-axis perpendicular to the scales. Spacing between the scales is as follows: Fig. 1, t to V, 4.5 in.; t to H, 6 in.; Fig. 2, V to V_1, 1.2 in.; V to P, 6 in.; Fig. 3, V_1 to V_2, 1.2 in.; V_1 to S, 6 in.

Fig. 1			Fig. 2			Fig. 3		
t	V	H	V	V_1	$P_{abs.}$	V_1	V_2	S
32—2.29	300—0.04	0.01—0.00	300—0.36	120—0.44	110—0.00	100—0.00	100—0.41	1.60—0.00
100—2.87	400—0.67	0.02—1.00	400—0.98	200—1.31	100—0.42	200—1.52	200—1.51	1.40—0.60
200—3.56	500—1.13	0.03—1.58	500—1.44	300—2.02	95—0.64	300—2.38	300—2.30	1.20—1.25
300—4.18	600—1.53	0.04—1.99	600—1.87	400—2.51	90—0.85	400—3.00	400—2.80	1.00—2.04
400—4.72	700—1.86	0.05—2.31	700—2.21	500—2.89	85—1.11	500—3.47	500—3.19	0.90—2.48
500—5.19	800—2.15	0.06—2.57	800—2.49	600—3.22	80—1.37	600—3.88	600—3.50	0.80—2.98
600—5.61	900—2.41	0.08—3.00	900—2.75	700—3.50	75—1.67	700—4.18	700—3.77	0.70—3.58
700—6.02	1,000—2.63	0.1—3.31	1,000—2.98	800—3.72	70—1.95	800—4.48	800—3.99	0.60—4.24
800—6.36	1,500—3.52	0.2—4.31	1,500—3.87	900—3.93	65—2.28	900—4.73	900—4.20	0.50—5.02
900—6.69	2,000—4.17	0.3—4.88	2,000—4.51	1,000—4.13	60—2.62	1,000—4.94	1,000—4.39	0.40—5.98
1,000—7.00	3,000—5.01	0.5—5.62	3,000—5.39	2,000—5.32	55—3.01	1,500—5.82	2,000—5.57	0.35—6.58
	4,000—5.64	0.7—6.09	4,000—6.02	3,000—6.04	50—3.41	2,000—6.49	3,000—6.28	0.30—7.24
	5,000—6.10	1.0—6.61	5,000—6.49	4,000—6.52	45—3.89	3,000—7.36	4,000—6.77	0.25—8.04
	6,000—6.50	1.5—7.20	6,000—6.88	5,000—6.91	40—4.38	4,000—7.95	5,000—7.15	0.20—9.00
	7,000—6.83	2.0—7.61	7,000—7.22	6,000—7.24	35—4.97	5,000—8.44	6,000—7.46	
	8,000—7.11	3.0—8.19	8,000—7.51	7,000—7.51	30—5.63	6,000—8.85	7,000—7.73	
	9,000—7.38	4.0—8.61	9,000—7.78	8,000—7.73	25—6.42	7,000—9.18	8,000—7.95	
	10,000—7.61	5.0—8.92	10,000—8.00	9,000—7.96	20—7.39	8,000—9.45	9,000—8.18	
	12,000—8.00	6.0—9.19	15,000—8.88	10,000—8.14	14.7—8.73	9,000—9.71	10,000—8.38	
	15,000—8.49					10,000—9.93	20,000—9.56	

tube should be that at a point in the duct situated about one-quarter of the radius from its edge. The center velocity is greater than the mean and will give a result considerably too large.

Since the greatest number of gas-flow calculations will concern air at approximately atmospheric pressure, the charts are based on air under these conditions (see Fig. 1) while corrections for greater pressures are made through the use of Fig. 2, and for gases other than air, through Fig. 3. Were it expedient to do so the charts might be combined but it is thought that their use will be facilitated through keeping them separate.

As a starting point Fig. 1, the basic chart, is computed from the formula:

$$V = 174.24\sqrt{t + 459.6}\sqrt{H} \qquad (1)$$

which is given by Martin for air at pressures near atmospheric and varying temperatures. In the equation, V = air velocity in feet per minute, t = air temperature in degrees F., and H = velocity head as measured with the Pitot tube, in inches w.g. In using Fig. 1, connect the velocity head, H, by means of a straight-edge with the temperature, t, reading the velocity of the air at the intersection with the velocity scale, V.

The equation given above is suitable for air at pressures not exceeding a few inches of water. The effect of any considerable increase in pressure is a diminution in velocity as shown by the following relationship:

$$V_1 = V\sqrt{\frac{P}{P_1}} \qquad (2)$$

where V_1 = velocity in feet per minute at pressure P_1, V = the velocity computed by means of equation (1), P = atmospheric pressure, 14.7 lb. per square inch, and P_1 = pressure in the pipe in pounds per square inch absolute. In determining the velocity of air at pressures above atmospheric, determine V from Fig. 1, then lay a straight-edge from V to P_1 on Fig. 2 and at the intersection read the corrected value of V_1.

Through the use of still another relationship, expressed by Fig. 3, the nomographs of Figs. 1 and 2 can be used for gases having specific gravities differing from air. The equation involved is:

$$V_2 = V_1\sqrt{\frac{1}{S}} \qquad (3)$$

where V_2 = gas velocity in feet per minute, V_1 = velocity at pressure, P_1, as determined from Fig. 2, and S = specific gravity of the gas relative to air as 1.0. To measure the velocity of such a gas, determine the equivalent velocity for air, V_1, from Figs. 1 and 2, then on Fig. 3, placing a straight-edge from V_1 to the known specific gravity of the gas, S, locate the actual velocity, V_2, on the middle scale.

Thus it will be apparent that, taken together, the three nomographs solve the equation:

$$V_2 = 174.24\sqrt{\frac{(t - 459.6)\ H\ P}{P_1\ S}} \qquad (4)$$

in which the terms are as given above in defining the equations.

Should the reader desire to reconstruct the nomographs to larger scale, he can do so readily through use of the accompanying tabulation. Each double column in the tabulation consists, first, of the magnitudes on the several scales of the nomographs, and second, of the distances in inches of each of these magnitudes above an arbitrarily chosen horizontal axis. For example, in reconstructing Fig. 1 to larger scale, the value of t = 400 will appear at a distance of 4.72 in. above a horizontal line which passes through H = 0.01, while V = 1,000 will appear at 2.63 in. above the line and H = 0.1 at 3.31 in. above the line. The spacing between the scales is as noted above the tabulation.

▼ ▼

Purging Gas-Containing Equipment

When equipment that is to contain a combustible gas is filled with the gas after it has contained air or when the gas is to be removed from the equipment and replaced with air, there will naturally be a range of concentrations of gas and air when explosive mixtures will be formed. This applies not only to the mains and equipment of gas plants but also to apparatus used for hydrogen, carbon monoxide, liquefied petroleum gases and other flammable gases. As has been pointed out by Herbert W. Aldrich, of the Consolidated Gas Co., New York, in his paper on "Purging Apparatus," given before the recent meeting of the American Gas Association, under such circumstances the proper procedure is to displace the gas, (or conversely, the air) with inert gas, after which the inert gas can in turn be displaced with air (or, conversely, with the gas).

One method of producing inert gas that has been found satisfactory in the gas plant has been to use one of the water gas generators for this purpose. It requires no additional investment and can produce large quantities of gas at low cost. Commercially-available inert-gas generators burning manufactured gas are now used for this purpose. Inert gas may be pumped by exhauster from the flue of a steam boiler, provided that the suction is not strong enough to draw air. Automotive equipment, including automobiles and portable, gasoline-driven air compressors has also been used successfully. For small purging operations, carbon dioxide or nitrogen in cylinders are sometimes employed. For safety, the inert gas should contain not more than 2 per cent oxygen nor show a combustible gas test more than 50 per cent of the lower explosive limit.

NEW EQUIPMENT

New Oxygen Absorber • High Capacity Dryer • Electric Temperature Signal • Steam-Operated Controller • Metal Sprayer • Electrical Equipment • Purging Machine • Speed-Reducer Motors • Improved Carboy Packing • Spliceable Rubber Belt • Castable Refractory • Storage Tank Heater • Submerged Heating Unit • Hydrogenation Apparatus • Thermo-Regulator • Mechanical Flow Meter • Rotary Crystallizer • Illumination Meter • Inverted Bucket Trap • Chemical Stoneware Exhauster • Oil-Proof Packing • Brazing Alloy • Through-Port Valve • Manufacturers' Latest Publications

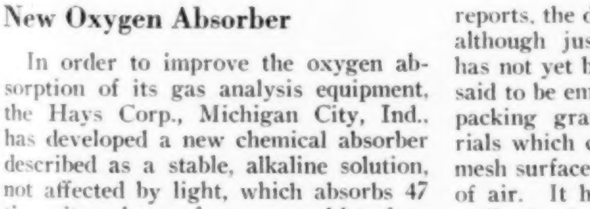
New Oxygen Absorber

In order to improve the oxygen absorption of its gas analysis equipment, the Hays Corp., Michigan City, Ind., has developed a new chemical absorber described as a stable, alkaline solution, not affected by light, which absorbs 47 times its volume of oxygen and has four times the capacity of pyrogallic acid solution. It is said that the new solution works with such speed that two passes of the sample through the absorption chamber suffices to remove the last trace of oxygen. This material has been given the name "SiezO_2."

High Capacity Dryer

What is known as the Dwight Lloyd Oliver dryer is an interesting development of the Dwight Lloyd sintering machine. The new dryer is manufactured by the Sintering Machinery Corp., New York City, and offered for sale by Oliver United Filters, Inc., 33 West 42d St., New York City. According to reports, the dryer has wide applicability, although just what its limitations are has not yet been fully determined. It is said to be eminently suitable for all non-packing granular or crystalline materials which can be supported on a wire mesh surface so as to permit the passage of air. It has also been used satisfactorily in the drying of lumps of filter cake as discharged from continuous filters.

The accompanying drawing illustrates the design. A series of screen-covered pallets carried on wheels forms a continuous bed which revolves on a roughly elliptical track under the propulsion of a large-diameter drive wheel. Wet solids are fed to the bed from a hopper at the right, passing under a scraper which regulates the thickness deposited. A current of heated air or furnace gases is then drawn through the material by an exhaust fan while the pallets are traveling toward the discharge. It is said that remarkably high efficiency is attained, partly from the fact that the air, sweeping downward through the material, mechanically blows a great deal of moisture from the particles. This mechanically removed moisture is largely separated from the air in the chambers below the pallets, from which it is removed through water seals.



Elevation of D.L.O. dryer for granular and crystalline materials

As a pressure of not over 3 in. w.g. is maintained over the bed of drying material, it is claimed that there is no tendency to force material through the screens. Because the solids are given little agitation, it is said that there is no breakage nor dusting. Power consumption is claimed to be less than that required for a rotary dryer of equal capacity.

Electric Temperature Signal

Determination of temperature by means of electric lights is possible with the new "Thermo-Tel" produced by the Uehling Instrument Co., Paterson, N. J. The instrument actuates colored electric lights by changes in temperature. When the temperature is within the limits for which the instrument is set a white light shows, whereas a red light appears for high temperature, while low temperature is shown by the extinguishing of both lights. Signals can be read at a distance of 200 ft. or more and are said to be accurate within less than one-tenth of 1 deg. F.

Steam-Operated Controller

Interesting design improvements are incorporated in a simplified and improved steam-operated temperature and pressure controller manufactured by C. J. Tagliabue Mfg. Co., Brooklyn, N. Y. The new machine operates on a principle similar to that of the company's original steam-operated controller which was described in the February, 1928, issue of *Chem. & Met.* However, stuffing boxes have been eliminated from the pilot-valve system through the use of metal bellows, so arranged that the pilot pressure is balanced and has no adverse effect on the setting of the pilot valve. This controller utilizes the upstream pressure of the fluid being handled (usually steam), operating through a pilot controlled by the temperature or pressure, to move a diaphragm and thus regulate a valve which controls the downstream pressure of the fluid.

Metal Sprayer

A new metal spraying gun, said to be capable of applying coatings of any metal that can be drawn into wire or rods, is being manufactured by the Metal Spray Co., Los Angeles, Calif. It is handled on the Pacific Coast by DeLaval Pacific Co., San Francisco, Calif., and it is understood that Eastern representation is being arranged. An air turbine supplies power to feed the wire which is melted by an oxyacetylene flame. Sandblasting is

New metal spray gun

necessary before depositing metals. Three sizes of gun are available, capable of covering up to about 900 sq.ft. per hour, depending on the metal sprayed.

Electrical Equipment

General Electric Co., Schenectady, N. Y., has announced two recent developments, including a new low-priced photoelectric relay and a new line of capacitors filled with a new dielectric liquid which is nonflammable and nonexplosive. The relay is applicable to installations where practically complete interception of the light beam is possible, including such uses as counting applications of all kinds. The relay will operate on light impulses of one-fifteenth second duration.

The new capacitors are used for power-factor correction and are filled with Pyranol, a dielectric material for which remarkable insulating properties are claimed. Capacitor units consist of one or more flattened rolls of paper and aluminum foil pressed together and inclosed under Pyranol in a hermetically-sealed steel case.

Purging Machine

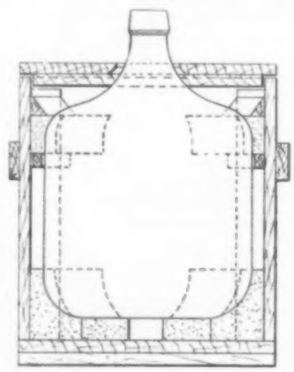
Through arrangement with A. D. Harrison, Brooklyn, N. Y., Roots-Connersville-Wilbraham, of Connersville, Ind., is manufacturing a machine used for purging gas holders, mains and other equipment in the oil and chemical industries. Air and fuel gas are supplied under pressure to produce an inert gas containing less than 1 per cent oxygen. The gas discharges through a cooler into the apparatus to be purged. These machines are available in sizes of 15,000 and 35,000 cu.ft. of inerts per hour, measured at 60 deg. F., and 2 lb. discharge pressure.

Speed-Reducer Motors

Falk Corp., Milwaukee, Wis., has announced three new styles of combined motor and speed reducer to which have been given the name of "Motoreducers." All types are supplied in horsepowers from ½ to 75 with ratios from 4.6 to 288. Non-planetary, helical-type gears are used throughout with oversize ball-bearings in all but the largest sizes. In the "integral" type, the motor and reducer housing are continuous. The "flexible" type is similar except that the reducer is attached to the motor end bell. The "all-motor" type may use any standard, horizontal-type motor which is mounted in a special reducer housing and connected through a flexible coupling.

Improved Carboy Packing

A new type of cork cushion has recently been designed by the Armstrong Cork Co., Lancaster, Pa., for supporting glass carboys within their wooden containers. This design was developed with the cooperation of one of the large chemical shippers and is said practically to have eliminated the breakage of carboys. It is said further that carboys so packed will consistently pass drop-



Cork cushions in place

ping tests 2½ times as severe as those required by the I. C. C. Carboy maintainence costs are reported to have been reduced approximately 76 per cent by one user.

As is shown in the accompanying illustration, the new cork cushions support the carboy on the curved portions of the bottle which are stronger than the cylindrical surfaces. Support is over an area of approximately 200 sq.in. so that outside shocks are transmitted to a large area well adapted to receive them. Further advantages include the strength, light weight and chemical resistance of the cushions.

Spliceable Rubber Belt

"Highflex Junior" is the name of a new belt recently developed by the B. F. Goodrich Co., Akron, Ohio, for those applications where belts must be made endless in the field. It is stated that, heretofore, it has been impossible to install factory-made endless belts in certain locations. To circumvent this difficulty, a new belt using a great number of plies of specially woven fabric has been developed, together with a special cement and tie gum for making the splice. The new belt is available in widths of 6 in. and less and can, it is claimed, be readily spliced and installed by the user.

Castable Refractory

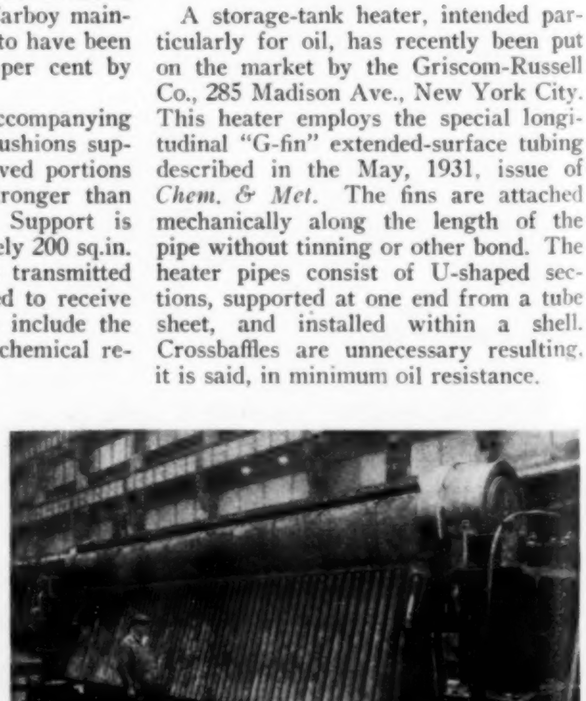
The Quigley Co., 56 W. 45th St., New York City, has introduced a new refractory material, capable of being cast or molded on the job, under the name of "Cast-Refract." The material air-sets quickly with high structural strength and can, it is claimed, be put under full heat within 24 hours or less. The material is shipped dry and is mixed with water on the job. It is capable of producing a monolithic structure that is said to be air and gas tight, free from shrinkage, highly resistant to spalling and of excellent refractory properties up to its temperature limit of 2,600-2,800 deg. F.

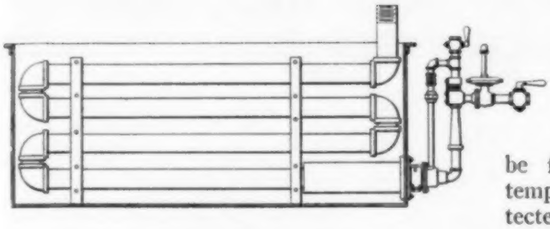
Storage Tank Heater

A storage-tank heater, intended particularly for oil, has recently been put on the market by the Griscom-Russell Co., 285 Madison Ave., New York City. This heater employs the special longitudinal "G-fin" extended-surface tubing described in the May, 1931, issue of *Chem. & Met.* The fins are attached mechanically along the length of the pipe without tinning or other bond. The heater pipes consist of U-shaped sections, supported at one end from a tube sheet, and installed within a shell. Crossbaffles are unnecessary resulting, it is said, in minimum oil resistance.

One of seven all-welded mercury-boiler units to be installed in the General Electric Co.'s mercury-vapor plant at Schenectady, N. Y.

The tubular elements extending down from the drum are the mercury evaporators in which a thin film of mercury receives heat from the furnace gases. The station, which is to have a capacity of 20,000 kw., is the largest mercury-vapor plant yet built. It is to supply process steam to the General Electric Co. and power for the local utility lines.





Immersion heater of proportional mixer type installed in steel tank

Submerged Heating Unit

A recent development in heating equipment is a gas-fired immersion heater that has been put on the market by the Steam & Combustion Co., 1559 Sheffield Ave., Chicago, Ill. The principle of this device is well illustrated by the accompanying drawing. A submerged, refractory-lined combustion chamber extends into a pipe line, also submerged, both elements supplying the necessary surface for heat transfer.

These heaters are provided in two standard constructions, the two-valve type and the proportional mixer type. In the former, the air and gas suoolies are controlled manually. In the latter, control of the gas supply automatically adjusts the air flow. Automatic temperature control and automatic electric or gas ignition are available if necessary. Where the tank cannot be cut, the combustion chamber may be inserted from the top.

In choosing submerged combustion units, it is customary to provide 1 sq.ft. of internal surface for each 10,000-12,000 B.t.u. input per hour. When heating water at 200 deg. F., the overall efficiency of the appliance is said to be approximately 83 per cent. Available sizes give capacities up to 600,000 B.t.u. per hour.

Hydrogenation Apparatus

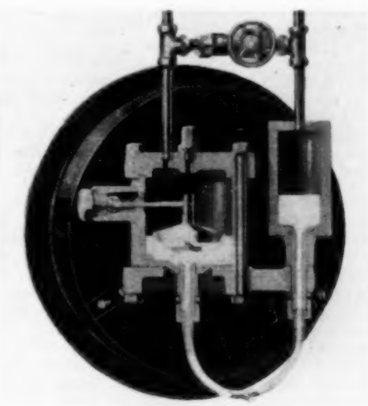
American Instrument Co., 774 Girard St. N.W., Washington, D. C., has announced a complete line of apparatus for laboratory and semi-works-scale hydrogenation at high temperatures and pressures. Autoclaves are designed for use at pressures up to 15,000 lb. per square inch and temperatures up to 752 deg. F. A hydrogenation assembly includes the autoclave, heating jacket, motor-driven shaker and all necessary high-pressure fittings, gages, and so on.

Thermo-Regulator

Accuracy within 1/10 of a degree of the setting is claimed for the new "Red Top" thermo-regulator announced by Hiergesell Brothers, 2518 N. Broad St., Philadelphia, Pa. This regulator is an improved form of modified Beckmann thermometer, consisting of a glass capillary containing sealed-in electrodes of special metal, topped with a storage chamber into which excess mercury may be forced in setting the control temperature. The apparatus is protected by a heavy glass shell and inclosed at the top with an insulating cap carrying the terminals. The company is prepared to supply relays for use with this regulator.

Mechanical Flow Meter

As a companion to its electric flow meter, the Brown Instrument Co., Philadelphia, Pa., has added to its line a series of mechanical flow meters available with both square-root and evenly divided charts, with or without totalizer and/or automatic control. The new line may employ additional pens for flow, pressure or temperature and may utilize compensation for pressure and temperature.



New mechanical flow meter

As is shown in the accompanying view, the mechanism consists of a mercury U-tube containing a large float connected through a pressure-tight bearing to the recording mechanism. Interchangeable range tubes permit altering the range of the meter without disturbing the orifice. All models are available with either hand-wound or electric clocks. Control models have been developed in single and duplex forms and operate mercury switches for handling up to 15 amp. at 110 volts without a relay.

Rotary Crystallizer

Fan cooling to remove the heat of crystallization is employed in a rotary, tubular crystallizer recently put on the market by Zahn & Co., G.m.b.H., Berlin W.15, Germany. The crystallizer consists of a tube supported on rollers. The hot, saturated salt solution continuously enters the tube at one end where it is cooled by a current of air blown against it by a fan. The crystals form as the liquid passes toward the outlet opening. Through the slight inclination of the tube, they are discharged continuously together with the mother liquor into a drainage box.

The new crystallizer has been used in the continuous manufacture of glaubers salt, sodium sulphite and bisulphite, various phosphates, ammonium and sodium nitrates, potassium chlorate and numerous other salts. It is claimed to be capable of producing large crystals of uniform size with very little labor. The standard construction gives an output of 1,500 kg., or more, per 24 hours. A modified design makes possible an output of 4-12 tons per 24 hours.

Illumination Meter

Latest of the applications of the Weston Photronic Cell, manufactured by the Weston Electrical Instrument Corp., Newark, N. J., is a pocket-size foot-candle meter for measuring illumination in the range up to 500 ft.-candles. The device employs one Photronic cell and, except for this feature and the smaller size, is similar to the earlier meter described in *Chem. & Met.*, December, 1931, page 728.

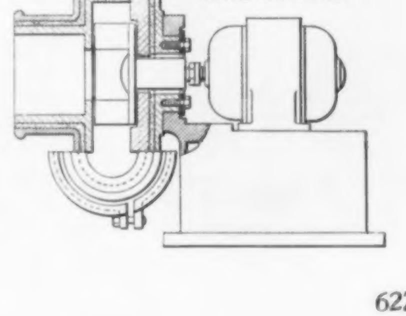
Inverted Bucket Trap

Improved features are incorporated in a new inverted-bucket steam trap recently announced by The Swartwout Co., 18511 Euclid Ave., Cleveland, Ohio. Through a special support for the bucket, the opening and closing actions are said to be powerful and positive. Valve disks are made of stainless steel and the disks and seats are heat treated to produce a hard, long-wearing surface. Trap sizes range from ½ to 2 in.

Chemical Stoneware Exhauster

What is said to be the first chemical-stoneware-lined fan designed especially for low-pressure service, has recently been announced by the United States Stoneware Co., 50 Church St., New York City. The new exhausters are

New stoneware-lined exhauster



built particularly for ventilation service under severely corrosive conditions. All parts coming in contact with the gases are of chemical stoneware, protected by an outer armor of cast iron. Operation is said to be practically without vibration because of perfect alignment and rigidity. Efficiency is said to be better than that of the usual small-sized exhauster. The discharge of the exhauster may be swung through 360 deg. and locked at any angle. Totally-inclosed ball bearings are available if desired.

Oil-Proof Packing

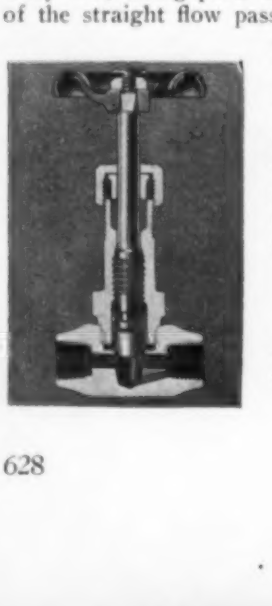
Granulated cork has been combined with tough paper fiber in a new sheet packing material for gasoline, oil and water, developed by the Garlock Packing Co., Palmyra, N. Y. This material, which has been given the designation Garlock 660, is said to be soft enough to seal flanges or joints that are improperly machined or in poor condition and yet tough enough to permit its use in installations requiring very thin gaskets. It is manufactured in all standard thicknesses from 0.01 to 0.5 in. Gaskets cut from this material may be furnished to size.

Brazing Alloy

Quick penetration, self-fluxing characteristics and a low melting point of 1,300 deg. F. are important features of a new brazing alloy containing silver, copper and phosphorus, manufactured by Handy & Harman, 57 William St., New York City, under the trade name of "Sil-Fos." The alloy is used for producing joints in copper, brass and bronze, giving an average tensile strength of 33,000 lb. per square inch in copper-to-copper joints.

Through-Port Valve

An accompanying illustration shows the construction of a new type of valve recommended particularly for refinery and similar services which has recently been developed by Reading-Pratt & Cady Co., Bridgeport, Conn. Because of the straight flow passage, the valve can be cleaned very readily. A relief passage is provided at the bottom of the opening to permit escape of fluid caught under the plug.



Construction of new Through-Port valve

MANUFACTURERS' LATEST PUBLICATIONS

Achema VII. Dechema Seelze, near Hannover, Germany—10-page prospectus of the German chemical exposition, Achema VII, to be held in Cologne, from June 1 to June 11, 1933.

Agitation. Patterson Foundry & Machine Co., East Liverpool, Ohio—Folder describing this company's portable, propeller-type mixer.

Ceramic Ware. General Ceramics Co., 71 West 35th St., New York City—Two recent reprints of articles by P. C. Kingsbury, one on ceramic ware for chemical equipment, and the other a general discussion of the manufacture and use of chemical ceramic ware.

Disintegration. Raymond Bros. Impact Pulverizer Co., 1302 North Branch St., Chicago, Ill.—Leaflet describing the use of this company's kiln mill in the production of ground, dried materials. Describes the use of this system in drying and calcining such materials as copper sulphate and gypsum.

Emulsions. Glyco Products Co., Bush Terminal Building No. 5, Brooklyn, N. Y.—12-page folder on emulsifying agents, synthetic waxes, resins, etc., with new formulas for producing emulsions and other products.

Engineering Services. Freyn Engineering Co., 310 South Michigan Ave., Chicago, Ill.—Issue of a publication entitled "Freyn Design," devoted to this company's activities in industrial construction and equipment installation.

Equipment. The Hardinge Co., York, Pa.—Folder briefly describing this company's constant-weight feeder and stressing relative merits of spiral and segmental clarifier scrapers.

Flow Meters. Bailey Meter Co., 1050 Ivanhoe Rd., Cleveland, Ohio—Bulletin 300—24 pages on a new line of fluid meters recently introduced by this company.

Flow Meters. Brown Instrument Co., Philadelphia, Pa.—Folder graphically describing construction of a new line of mechanical flow meters made by this company.

Flow Meters. Builders Iron Foundry, Providence, R. I.—Bulletin 262—4 pages on a recent long-distance meter-recording demonstration of this company's Chronoflo meter.

Furnaces. W. S. Rockwell Co., 50 Church St., New York City—Catalog 335—4 pages on roller-hearth furnaces.

Glass Containers. Kimble Glass Co., Vineland, N. J.—Form 2—16 pages on this company's automatic-machine-made vials for drug, pharmaceutical and perfume products.

Hard Rubber. American Hard Rubber Co., 11 Mercer St., New York City—Catalog 1—16 pages on hard-rubber products for industrial purposes, listing properties, forms in which available, and giving working methods.

Heating Units. Harold E. Trent Co., 618 North 54th St., Philadelphia, Pa.—Leaflet describing electric immersion heaters made by this company.

Humidigraphs. The Bristol Co., Waterbury, Conn.—Bulletin 413—Folder describing a new direct-reading relative-humidity recorder, made by this company.

Industrial Cleaning. Dow Chemical Co., Midland, Mich.—16 pages completely describing industrial cleaning methods and comparing solvents used for this purpose. Describes one form of equipment.

Lacquers. Hercules Powder Co., Wilmington, Del.—Form 514—10-page booklet presenting a summary of practical laboratory methods for checking characteristics of lacquers.

Lubrication. Achison Oildag Co., Port Huron, Mich.—Technical Bulletin 130.3—3 pages on colloidal graphite as a high temperature lubricant.

Lubrication. The Lunkenheimer Co., Cincinnati, Ohio—8 pages on this company's new line of bottle oilers.

Materials Handling. Diamond Rubber Co., Akron, Ohio—24 pages, illustrating graphically the solution of materials-handling problems with belt conveyors.

Metals and Alloys. Electro Metallurgical Co., 30 East 42d St., New York City—Folder on the use of stainless steel in breweries. Also folder describing the use of stainless steel in dyeing equipment.

Packing. Garlock Packing Co., Palmyra, N. Y.—General Catalog B-1932—155 pages covering the entire range of packing materials made by this company. Includes packing for rods, plungers, rams, shafts, pistons and valves, and sheet packing materials and gaskets of all sorts.

Paint. B. F. Goodrich Rubber Co., Akron, Ohio—Bulletin describing a new line of rubber-isomer-base paints now available from this company under the name of "Acidseal Paints."

Pipe Fittings. The Parker Appliance Co., Cleveland, Ohio—Catalog 34—40 pages on copper plumbing with this company's new line of "Innerseal" fittings.

Power Transmission. Dayton Rubber Mfg. Co., Dayton, Ohio—Catalog 105, Condensed—32 pages of prices and engineering data on this company's "Cog Belt" drives.

Power Transmission. Engineer's Specialty Co., 549 West Randolph St., Chicago, Ill.—10 pages on a one-way clutch recently purchased by this concern from the Columbia Industrial Machinery Co.

Power Transmission. Link-Belt Co., 910 S. Michigan Ave., Chicago, Ill.—Catalog 1192—144-page catalog on steel chains made by this company, giving specifications, dimensions, strengths and list prices on chains for elevating, conveying and power transmission.

Power Transmission. Reeves Pulley Co., Columbus, Ind.—Catalog V-200—10 pages on construction and uses of this company's new "Vari-Speed" motor pulley.

Production Control. Graybar Electric Co., Graybar Bldg., Lexington Ave., New York City—12-page booklet describing the "Chronolog," a recording operation meter for determining the causes of lost production time.

Pumps. Morris Machine Works, Baldwinsville, N. Y.—Bulletin 148—20 pages with engineering data and flow charts on this company's centrifugal pumps for pulp and paper mills.

Pumps. Worthington Pump & Machinery Corp., Harrison, N. J.—Publications as follows: W-323-B1, 4 pages on automatically primed centrifugal pumps; D-450-S12, 4 pages on drainage and irrigation pumps; D-450-S9, 10 and 11, 4-page bulletins covering deep-well pumps in sizes from 6 to 20 in.

Refractories. General Refractories Co., Philadelphia, Pa.—Collection of new folders and bulletins on Carbex silicon-carbide brick with information on properties and uses.

Refractories. Laclede-Christy, St. Louis, Mo.—Leaflet describing and listing performances of this company's mullite refractories.

Sewage Disposal. Jeffrey Mfg. Co., Columbus, Ohio—Bulletin 545—15 pages on conveying and reduction machinery for sewage disposal plants.

Steam Generation. Air Preheater Corp., 40 East 34th St., New York City—Bulletin 932—8 pages on the use of the Ljungström air preheater in eliminating unproductive boiler surface.

Steam Generators. Commonwealth Electric & Mfg. Co., 83 Boston St., Boston, Mass.—Bulletin 52—4 pages on a new line of miniature electric steam generators in sizes from 2 to 5 kw.

Valves. Schutte & Koerting Co., Philadelphia, Pa.—Leaflet describing two new valves for pressure relief and back pressure service in fuel oil and lubricating oil lines.

Welding. Linde Air Products Co., 30 East 42d St., New York City—Booklet describing respectively Oxweld No. 25M bronze welding rod and Prest-O-Lite welding torches.

Welding. The Stoody Co., Whittier, Calif. Catalog 105—27 pages on welding and grinding equipment including hard-surfacing materials, welding rods, grinding machines, electric welders and accessories.

NEWS OF THE INDUSTRY

Depreciation of foreign currencies and anti-dumping charges engage attention of U. S. Tariff Commission. Fertilizer and gas industries hold society conventions and chemical engineers make plans for twenty-fifth anniversary meeting. Chilean nitrate situation becomes more involved by report that the government will reorganize the industry and take over all activities

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Chemical Engineers to Celebrate Silver Anniversary

The twenty-fifth annual meeting of the American Institute of Chemical Engineers will be held in Washington, D. C., Dec. 7, 8 and 9. Plans just announced for the program, under the general chairmanship of R. S. McBride, include not only the usual technical sessions and social activities, but also a family birthday party to celebrate the silver anniversary of the organization of the chemical engineering profession in this country. It is expected that as many as possible of the founders and charter members of the Institute will attend this session and participate in the celebration. A special souvenir pamphlet is being prepared for distribution on this occasion. It will not only review the very interesting events that led to the founding of the Institute, but will also include chapters on the development of chemical engineering education and the progress made in industrial research during the past twenty-five years. Dr. John C. Olsen, Prof. Alfred H. White, and Dr. Arthur D. Little have collaborated with the editor, S. D. Kirkpatrick, in the preparation of this unique volume.

Symposium on patents

Dr. Harrison E. Howe, chairman in charge of the technical sessions, announces that one of the features of the meeting is to be a patent symposium held on the afternoon of Dec. 7 in the auditorium of the U. S. Patent Office, Department of Commerce, which is directly across Pennsylvania Avenue from the Hotel Washington, headquarters of the Institute. The symposium will be introduced with a paper on "A Corporation Patent Department" by Thomas H. Griswold of the Dow Chemical Co. There will then follow the report of the Patent Committee of the Institute summarizing the status of federal legislation at the moment, and a round table on "The Ownership of Intellectual Property." E. R. Weidlein will discuss the patent problems of the endowed quasi-public type of institution; James R. Withrow, the patent problem of education institutions; L. W. Wallace, the patent status of government employees; F. G. Cottrell will report the experience of the Research Corporation in patent matters; and Karl Fenning, a prominent patent attorney of Washington, identified with the American Patent Bar, will present the legal aspects of the above problems. This will be followed by a few remarks from the Commissioner of Patents, Thomas E. Robertson, and a brief visit to examine the facilities of the Patent Department in its new quarters.

The concluding technical session on the morning of December 8th will be devoted to "Some Economic Problems of the Process Industries." A. G. Peterkin and H. W. Jones, of the Atlantic Refining Co., will present a paper on "Cost Accounting and the Chemical Engineer"; Harry M. Mabey, of Mathieson Alkali Works, will discuss "Transportation Problems of 1932"; Dr. H. G. Knight, "Agricultural Raw Materials for the Process Industries," and Prof. W. L. McCabe "The Use of 'Availability' in Process Steam Cost Accounting Practice."

Gas Industry Discusses Technical Problems

The gas industry held its annual convention under the auspices of American Gas Association at Atlantic City October 10-12. About 1,200 registered members participated in a much curtailed series of sessions. This attendance, less than a quarter of that normal for these sessions, was undoubtedly greatly reduced because no exhibits were shown.

Officers elected for the coming year included President Arthur Hewitt of Toronto, who succeeds R. W. Gallagher of Cleveland. The Technical Section for the coming year will be under the chairmanship of J. A. Perry of United Gas Improvement Co., advanced from the post of vice-chairman, and O. S. Hagerman of Chicago, newly elected vice-chairman. I. K. Peck, Midland United Co. of Chicago, is the retiring chairman.

The Beale medal, awarded annually for the outstanding technical contribution made to the program of the association, was this year presented to R. B. Harper, vice-president in charge of research of the Peoples Gas Light and Coke Co., Chicago, for his 1931 paper entitled "Gas Flames in Conversion to New Gases."

The series of three general sessions of the convention was supplemented by simultaneous sessions held each afternoon of the convention by the various sections of the association, dealing with natural gas, accounting, domestic and industrial merchandising problems, advertising, and technical subjects. Interest for chemical engineering, of course, is centered in the two sessions of the Technical Section dealing with distribution, production, and chemical problems of the industry. It is notable, however, that more than the usual attention was given this year to matters of supply of gas for industrial use. Particularly it is evident that the industry feels the necessity of preparing for a much wider application of public utility gas supplies in manufacturing works, both to increase the total gas usage and also to secure better load factors, especially increased gas utilization in the summer season.

Fertilizer Interests Discuss Problems of Agriculture

Discussion at the annual southern convention of the National Fertilizer Association at Atlanta Nov. 1-2 was devoted largely to policies for the restoration of agriculture rather than to the internal affairs of the industry. Curtailment of farm purchasing power not only has brought sales of fertilizer in southern states down to 2,400,000 tons this year from 5,600,000 tons in 1930 but has increased the credit risk as $1 spent for fertilizer now returns $2 instead of $3.50 when the price relations of farm products were normal. Manufacturing and selling costs have been cut but the production of less tonnage inevitably has thrust a larger overhead cost on each ton than when plants were operated closer to capacity.

Reports by leaders of the industry in the south indicate better business next year but it was recognized that any improvement will be casual and occasional until national policies are adopted that will give farmers a just share of the national income. Foremost among such policies, according to Charles J. Brand, executive secretary and treasurer of the association, is the adaptation of the tariff as an instrument for the benefit of the producers of export products. This is embodied in the domestic allotment plan. Other problems of agriculture to which, in Mr. Brand's opinion, attention by the fertilizer industry will serve its own interest are agricultural credit, mortgage debt, interest rates, land utilization, tax delinquency, foreign debts and freight rates.

Reports by manufacturers noted progress toward uniformity in labeling as a result of conferences held recently in several states with control officials and agronomists. This will tend to concentration on fewer grades with a consequent reduction in costs of production and sale.

Bayless W. Haynes, president of the association and president of Wilson & Toomer Fertilizer Co., Jacksonville, urged active cooperation by fertilizer manufacturers with banking, business and farm leaders in dealing with the difficult situation resulting from the low farm prices during the past two years. William S. Elliott, president of the Georgia State Bankers' Association, declared that business recovery has been retarded by the delay of many industries supplying the farmers' needs to adjust their prices, which stand at 106 per cent of the pre-war level, to farm prices, which stand at 59 per cent. But even a general lowering of the price level will not solve the problem of the man in debt, said Mr. Elliott, as most outstanding debts were made when the dollar was much cheaper. Lee Ashcraft, of Atlanta, presided at the annual dinner at which Eugene Talmadge, governor-elect of Georgia, and G. Claud Adams, who will succeed Mr. Talmadge as Commissioner of Agriculture, were guests of honor.

Expand Engineering Forces to Promote Modernization

Expressing confidence in the fact that a definite turn has come in the present business cycle and that improvements now under way in the process industries will lead to a normal and healthy growth, C. R. Walmsley, president of the Leader Industries, Inc. of Decatur, Ill., has authorized a broad expansion of the chemical engineering activities of his company. Important additions have been made to the technical staff in accordance with a definite plan that is unique in its conception and likely to lead to a greater participation of chemical engineers in the design and construction of process equipment. Announcement is to be made later regarding the personnel of an Associated Board of Technical Experts, whose research ability and engineering experience will be used in specialized fields.

Dr. Eugene H. Leslie, head of the Leslie Laboratories of Ann Arbor, Mich., is to serve as technical director in charge of all research and development work for the Leader Industries. His staff of chemists and engineers, his laboratory facilities, and his own extensive experience in the chemical engineering field, will be available for the study of new processes and products. He will continue to give attention to distillation research and petroleum refining, which has long been his specialty.

Franklin M. de Beers, prominent chemical engineering executive who founded the Swenson Evaporator Co. and has since been identified with other important projects, is to be in charge of the process machinery and equipment division. He will be assisted by E. C. McDonald and John B. Wood, engineers, who have been engaged for a number of years in the design and sale of heat transfer apparatus. It is expected that new designs and improvements in process equipment will be made through the use of the added facilities and experience of the enlarged organization.

Another interesting feature of Mr. Walmsley's program is a planning and financial service department which will cooperate with those whose projects are self-liquidating out of increased savings and reduced costs. Thus limited working capital need not necessarily postpone a program that definitely assures a manufacturer of the rapid amortization of his investment through profit or savings that are directly traceable to the modernization of his plant.

Mechanical Engineers Await Tenth Annual Power Show

Coincident with the annual meeting of the American Society of Mechanical Engineers, the Tenth National Exposition of Power and Mechanical Engineering is to be held at the Grand Central Palace in New York, during the week of Dec. 5-10, inclusive. According to present indications many of the more than 300 exhibits will be of direct value to chemical engineers. One of the most interesting of the educational features of the week will be a display which attacks the problem of air pollution from a number of different angles. This is to be a cooperative effort on the part of the New York City Department of Health, the New York Meteorological Observatory of the U. S. Weather Bureau, the Stevens Institute of Technology and other smoke enforcement bureaus. The exhibits will treat of the physiological and economic aspects of air pollution and the progress that is being made toward its abatement.

New York Group of Alpha Chi Sigma Will Meet Dec. 7

Co-incident with the celebration of the thirtieth anniversary of the founding of Alpha Chi Sigma, the professional chemical fraternity, Dr. Carleton Ellis of Montclair, N. J., is to address a meeting of the New York Professional Group, to be held in the McGraw-Hill Building on Dec. 7. Mr. Ellis is to speak on recent developments in the field of synthetic resins and will exhibit a number of samples of products made from these new materials. A dinner at 6:30 P.M. will precede the meeting, which will be open to all members of Alpha Chi Sigma who send in their reservations to the chairman of the New York Group, F. F. E. Kopecky, 26 Berkeley Heights Park, Bloomfield, N. J.

H. L. Derby Heads Relief Group Committee

Harry L. Derby, president of the American Cyanamid Co., has accepted the chairmanship of the Chemicals and Paints group to help the Emergency Unemployment Relief Committee raise funds for unemployment relief this winter. The division, which is organizing 100 major trade groups through which funds will be solicited from employers, employees and employees' associations, last year raised more than $10,000,000 of the more than $19,000,000 raised by the committee to finance work and direct relief for the jobless. Each group will be headed by a prominent representative of the industries which it comprises.

NEWS FROM WASHINGTON

By PAUL WOOTON
Washington Correspondent of Chem. & Met.

PRESIDENT HOOVER'S call on the Tariff Commission to determine as soon as possible the extent to which depreciation in foreign currencies can be overcome by increasing duties on 16 groups of products, including chemicals, offers a much more effective means of relief than the hysterical attempt by desperate manufacturers to invoke the anti-dumping law. That law requires proof first, that the exporter's sale price or importer's purchase price is actually lower than the home market value or cost of production; second, that domestic industries have been injured by dumping that is found to exist.

The Bureau of Customs is able and willing to collect the price data that may support this charge but domestic manufacturers themselves must produce some evidence that it is dumping and not its corrollary, the depreciation in foreign currencies or the depression in general that has hurt their business. Many of them do not even recognize such a distinction, not to speak of producing proof that it exists.

The President referred to chemical products in general terms but by mentioning Charleston, W. Va., Hopewell, Va., Arlington, N. J., Leominster, Mass., and Barberton, Ohio, as towns that have been hard hit by foreign competition, he identified the competing products as ammonium sulphate, pyroxilin products and matches.

As regards ammonium sulphate Mr. Hoover's selection was unfortunate. There is nothing that he nor the Tariff Commission can do to remedy this situation as ammonium sulphate is on the free list and the President's authority under the flexible tariff does not extend to transferring a product from the free to the dutiable list.

The only antidote for European competition, in this instance, is the anti-dumping law. Anti-dumping orders were issued last August against imports of ammonium sulphate from Germany, Belgium and Poland but imports from Holland, the transshipping point, apparently are beyond the reach of the anti-dumping statute because Holland's own production cost, that is the yardstick for comparison with the importer's purchase price on all ammonium sulphate shipped from Holland to the United States, happens to be very low.

So there's no apparent remedy for the blunder that Congress made in 1930 by removing the duty of $5.25 per ton. At that time the United States was the largest producer and exports were equivalent to present imports. Now imports are equivalent to 50 per cent of domestic production and the producers of byproduct ammonia from coke and gas distillation in 21 states as well as the producers of synthetic sodium nitrate and synthetic nitrogen at Charleston and Hopewell are suffering.

By directing the Tariff Commission's attention to chemical products manufacturers in Arlington, N. J., Leominster, Mass., and Barberton, Ohio, President Hoover stepped on solid ground. Arlington and Leominster are centers of the manufacture of pyroxilin and pyroxilin products and an increase in duty would serve to fend off Japanese competition. Distress has resulted not so much from the volume of imports as from the virtually non-profit selling condition aggravated by low-priced imports. The Japanese products not only compete with the firms making finished articles but curtail the market for the makers of rods, sheets and tubes.

Matches are produced by 21 plants scattered through several states but Barberton, Ohio, was referred to by Mr. Hoover because it is the center of this industry. It is assailed by competition from many countries. Anti-dumping orders now discipline imports from Austria, Estonia, Finland, Holland, Latvia, Norway, Poland, Soviet Russia and Sweden, but a greater measure of protection would be afforded by raising the tariff.

But the chemical industry will gain more from the protection of other industries than its own. Chemical raw materials are essential to many industries and higher duties on pottery, rubber footwear and other products will expand the market for chemicals. It was for this reason that President Hoover declared that an increase in tariff duties in other schedules would serve to restore employment in chemical plants in Philadelphia, Cleveland, New York and Chicago.

The tariff that many industries are leaning on today is a broken reed. Tariff duties are fixed by Congress in the light of many factors, including the prevalent rate of exchange. But subsequent fluctuations in exchange rates have an even more disastrous effect that a reduction in foreign labor costs as the depreciation of foreign currencies affects not only wages but all elements entering into the cost of production.

Notices of suspected dumping of manganese ore from Soviet Russia and stearic acid from the Netherlands have been issued, which have the effect of suspending imports unless importers post bonds. The Treasury Department has refused to act on charges of alleged dumping of manganese ore from Soviet Russia in the past but Andrew Mellon no longer is Secretary of the Treasury and the Steel industry, that is now seeking protection of the anti-dumping law on its own behalf against Belgian steel products, is not in a position to plead that the law should not be enforced against raw material from Soviet Russia.

Recent offers from Japan of acetic acid and other chemicals at low prices have not been reflected in any substantial shipments to date, according to Warren Watson, executive secretary of the Manufacturing Chemists Association.

L. F. Hitchner, president of the Lucas Kil Tone Company, has been appointed chairman of the insecticide and fungicide committee of the M. C. A., organized following amalgamation of the Agricultural Insecticide and Fungicide Association with the M. C. A.

To promote closer cooperation between the Department of Commerce and the trade associations, individual members of the staff of the Bureau of Foreign and Domestic Commerce are being designated to contact particular associations. It is to be the duty of the individual thus selected to keep in constant touch with the association assigned to him and be in a position at all times to supply information as to its activities. While the personnel of the commodity division in the past have kept in close contact with the principal associations in their fields, it has been found that close relationships were being maintained with a relatively small total of the active associations.

It was found that a member of the merchandising research staff formerly had been connected with the jewelry industry. Because of his knowledge of that particular field, he has been designated as contact man with the National Retail Jewelers' Association.

As a result of such a contact with the Plumbing and Heating Industries Bureau, arrangements have been made for the Weather Bureau to furnish data as to temperatures for all villages and towns in the southern Appalachian mountains. In a general way sales efforts in connection with oil burners and furnaces have not been extended south of the Mason and Dixon line. It had not been generally realized that the area of cold winter weather drops far to the South in the mountains.

NEWS FROM ABROAD

By Special Correspondents of Chem. & Met. at London, Berlin and Paris

London

THE annual report of the Association of British Chemical Manufacturers gives a very useful survey of its own work, and of the general trend, and the proceedings at the annual meeting gave some indication of the advice tendered by its chairman and general manager on their return from Ottawa and the United States. The main agreements, in so far as the Ottawa proceedings have affected chemical products, have already been summarized in the technical press. Obviously group sales organizations depend for their success largely upon correct and adequate grouping according to the goods manufactured and the prospects of trade, and manufacturers other than I.C.I., have explored this field, but have not applied it even within the restricted limits adopted by the I.C.I. organization. All such proposals are obviously linked with the provision of British capital, the maintenance of stocks and above all, the matter of personnel and executive responsibility actually represented in the country concerned, a point which has definitely been neglected in the past, on account of expediency, cost and indifference.

The patent litigation previously referred to in these notes, and instituted by British Celanese against Courtaulds, Ltd., the Cellulose Acetate Silk Company, etc., is now coming to a head with the case opened by Sir Arthur Colefax K.C. in the High Court on Nov. 1. It is likely to be a protracted affair, in which the leading counsel and experts will be engaged, and failing the unlikely event of a settlement being reached, will undoubtedly be taken to the Court of Appeal or even further. Naturally British Celanese have selected their ground to best advantage and concentrated on four of their very numerous patents; to the charge of infringement, there will be the usual claim disputing validity to form a defensive front. British Celanese in their annual report state that they have made in advance ample provision for the cost of this litigation, and while it is rash to prophesy, the general feeling is that no party is likely to benefit ultimately, that the British Celanese claims are unlikely to be successful to any material extent, unless the prime object is to cause annoyance, expense, loss of time and energy.

The Second Jubilee Memorial Lecture of the Society of Chemical Industry has been delivered by Dr. A. D. Dunstan, under the title of "Fluid Fuels To-Day and Tomorrow." Dr. Dunstan is chief chemist of the Anglo-Persian Oil Co. and is a man of outstanding technical and business vision. He concludes that it is cheaper and better to have a reserve of oil in this country than to spend large sums of money on illusory schemes of producing oil by low temperature carbonization or hydrogenation, and in the former case reaches the usual conclusion that it would be very difficult to sell or work up the low temperature tar. With hydrogenation one uses at present substantially the equivalent of 4 tons of coal to make 1 ton of oil, but seeing that coal is still the basis for some 70 per cent of the power produced in the world, the coal era cannot really be regarded as over.

The Plastics Group of the Society of Chemical Industry was very successfully inaugurated this month under the Chairmanship of H. V. Potter. It will take time before it can emulate the success of the Chemical Engineering Group, but it is wisely taking advantage of the experience so gained, and in particular is concentrating upon the field of plastic materials of organic origin and synthetic organic products. Obviously, rubber, clay, cement, road making materials and the like are already satisfactorily taken care of elsewhere. At the annual meeting of the Celanese Company, very important statements were made in regard to new yarns, stronger than natural silk, and others capable of being dyed and printed like cotton. The artificial wool, transparent paper and presumably film markets were also mentioned as being possible important developments, but in view of the previous history of the company, these prospects are regarded with some reserve.

Berlin

INCREASES in gasoline prices resulting from revenue measures imposed by the government, especially by the compulsory addition of alcohol, have almost resulted in a demoralization of the automotive industry. A petition made by the Berlin Chamber of Commerce and the National Society for Power Transportation calls for an immediate reduction of 50 per cent in this tax. The statement is made in this petition that the present policy of the government, to produce revenue and to favor production of alcohol from potatoes, has created a situation that makes recovery in this field more difficult. Fear is expressed that if the petition is not considered about half a million motor vehicles, about one third of the total number in use, will be withdrawn from service during the coming winter.

The stagnation in trade is still making itself felt; the old chemical enterprise Schuster u. Wilhelmi which was forced to liquidate has been taken over by Schering Kahlbaum A.-G.; the well known asphalt paving firm Johannes Jeserich A.-G. reports a loss of about 390,000 marks for 1931, and reports of similar nature are appearing daily.

German export of coal-tar dyes has decreased about 27 per cent since 1931; the figure for anilin and similar dyes declined from 19,000 to 13,700 tons, or from 81,600,000 to 63,200,000 marks. Export to China showed the largest drop, from 6,353 tons in the first half of 1931 to 2,864 tons in 1932. On the other hand, import of dyes from Switzerland showed an increase, 1,792 tons in the first half of 1932, compared with 1,554 tons in 1931.

Favorable reports are made on the crude oil production in Hannover, which in August made a record with 18,987 tons. The government's program for relief work is bringing some activity to the asphalt business, and prospects for next year are looked upon with optimism. The Steel Institute is also looking forward to greater activity, caused by increased orders from the national railroads. A greater need is also in evidence abroad, but the difficult credit situation may prevent any immediate increase in orders from this source. The Steel Institute does, however, feel, that in many fields, the decline has been checked and that certain industries are even showing signs of improvement.

At the Wiesbaden conference of natural scientists W. Esmarch, of Siemenstadt, discussed the high frequency furnace, both from a theoretical and a practical point of view.

Dipl. Ing. C. Agte, Berlin, discussed the importance of the hard-metal Widia to the chemical industry. Hard metals offer many interesting possibilities in the manufacture of chemical equipment from metal, glass, or porcelain. High resistance to wear makes them ideal grinding media, for glass cutters, and for injectors.

Professor Berl, of Darmstadt discussed improvements in the chamber process and the complicated reaction involved in this process. He mentioned the fact, that with a partial pressure of nitrogen oxide of 280 atm., as high as 77 per cent of the sulphuric acid is con-

verted into the so-called purple acid. Measurements of the partial pressure of the nitrous vitriol at different concentrations gave an idea of the partial pressures in the Glover tower and the Gay-Lussac tower, as well as in the chambers. The pressure was found to increase with the temperature, with the nitrogen content of the nitrous vitriol, and with the water content of the sulphuric acid used as solvent. Even at the higher sulphuric acid concentration in the Gay-Lussac tower an appreciable pressure of the nitrous vitriol may be found, a fact having important bearing on the nitrogen losses. Presence of nitric acid causes a further increase in the pressure and added loss of nitrogen through liberation of N_2O_4. Tests with production of sulphuric acid under pressure showed that a pressure of 13 atm., other conditions remaining the same, resulted in an increase in chamber output of 1,500 per cent.

Brick-colored zinc oxide was produced by A. Kutzelnigg by dissolving zinc oxide in molten ammonium nitrate and blowing the superheated fusion. The red color was not affected by boiling in water or by heating to a red heat for a short time. It showed orange fluorescence when treated with ultraviolet light, in the same manner as oxide obtained from nitrate.

Paris

IMPORTANCE of the automotive industry has been emphasized by the automobile show held in Grand Palace in October. It is estimated that 1,690,000 cars are in use in France which places this country second only to the United States.

From the chemical point of view, there can be recognized the importance assumed by special steels and light alloys, especially those with an aluminum and magnesium base, in which the French metallurgical industry has made remarkable progress, to say nothing of the attached and associated industries, such as nickel plating, chromium plating, etc., which have been considerably developed.

But it is above all the question of carburetants which interests the chemical industry in anticipation of the possible developments which the refining of petroleum can take, a process which has just been introduced into this country. Let us recall first of all that we import 4,000,000 tons of various petroleum products; next we find that the French production, represented by the sole producer, The Ste. de Pechelbronn in Alsace, produces only 70,000 to 80,000 tons annually. For crude products, France imports from Venezuela, the United States, Persia, Ecuador, and Colombia; as to the refined products, important purchases are made in Russia. This country offers, indeed, particularly advantageous conditions, having no alliance with the great American, British, or Anglo-Holland trusts. In this connection we should especially note the importations for the eight months of 1932 rising to 5,200,000 hectoliters of gasoline, 410,000 quintal métrique of gas-oils, and 1,500,000 qm. of fuel oils.

But the most important fact is the re-installation of the petroleum refinery which had been almost completely abandoned before the war and which is now in process of being renovated under the propulsion of the State. Since 1924, the government had favored the formation of a French company having interests in the Irak Petroleum Co. which was then to found the French Refining Co. in which the French State participates through the intermediary of the Office of Combustible Liquids, created in the course of the war and which continues as an autonomous department. After long debates the petroleum statute was approved in 1921 by the French chambers.

The French Refining Co. actually is building a factory at Gonfreville l'Orcher which will be put into operation in the second quarter of 1933 and is capable of treating 700,000 tons, although later the production will be further expanded to 1,500,000 tons. This same firm is erecting a factory near Marseilles with an analogous production capacity, which will now be a neighbor of the factory of Chemical Products, and Refineries of Berre, an affiliated firm of St. Gobain.

From the first of September, there also is operating a refinery of the Northern Petroleum Refining Co., situated at Dunkirk; it is said that the first results are satisfactory, in spite of the fact that the firm for 1931 recorded a loss of more than 5,000,000 francs.

Mention has been made above of the Office of Combustible Liquids, established during the war, and which continues as an autonomous governmental organ, with a very important budget, providing for a toll retained on all imported combustible liquids. Thus it is that this office disposes of many millions of francs; it maintains the Petroleum School of Strasburg and has just established a new school in Paris for the education of engineers for explosive motors; it also subsidizes the drillings made in France, in Algeria, and in Morocco and Madagascar, which have not yet given appreciable results. However, important drillings were undertaken in French Equatorial Africa, a region near Gobain and the Middle Congo, for the discovery of new petroleum fields. Lastly it gives subsidies and encouragements to several specialists and certain laboratories for researches in the domain of synthetic carburetants in particular.

Meanwhile in interested centers there is gradually penetrating the conviction that the chemistry of petroleum is only in its infancy and that the refining of petrol with the byproducts which result from it will one day become equally important as that of coal tar. Although in this field France is not yet on a level with the United States, it is fitting, however, to note the studies made on various sides by engineers, chemists, research associations such as the Society of the Synthetic Carburetants, which has taken a recent patent for the hydration of olefins in the presence of catalyzers (French patent 733,601).

On the other hand, M. André Grebel has just published in the *Génie Civil* a study on cracking in which he has expressed as his conclusion the idea that the cracking is a part of a series of phenomena in heating of organic composition. His theory states it is a general phenomenon and not a particular instance limited to petroleum, as certain chemists of the School of Strasburg appear to believe.

Meanwhile the price of gasoline has fallen from 1124 fr. 70 centimes the English ton in March, 1930, to 378 francs the English ton in March, 1932.

Mitsubishi Will Build Ammonia Plant

Construction of a synthetic ammonia plant similar to that recently completed at Trail, B. C., for the Consolidated Mining & Smelting Company of Canada will now be proceeded with for the Mitsubishi Shoji Kaisha at Nagoya, Japan.

Contract has been awarded to the International Electrolytic Plant Co. of Sandycroft, Chester, England. A. Edgar Knowles, head of this organization, has just returned to Canada en route home to England from Japan with the signed contracts.

The plant to be built at Nagoya will cost $10,000,000 and will be one of the largest manufacturing enterprises in the Japanese empire. The contract of the International Electrolytic Plant Company, Mr. Knowles said, represented an amount of $500,000.

"I first went to Japan with the intention of staying a month, but I remained there six months to put the big deal over," said Mr. Knowles in an interview in Victoria, B. C. "The Mitsubishi company has contracted to purchase all my rights and will manufacture plant units at the dock-yard it operates at Kobe. The fertilizer plant will be built at Nagoya on 50 acres of land acquired for the manufacturing enterprise. Two years will elapse before the plant is ready for operation."

NAMES IN THE NEWS

Irving Langmuir, associate director of the research laboratory of the General Electric Co., and outstanding research chemist has been awarded the Nobel prize in chemistry. Dr. Langmuir has made many contributions to the science of chemistry and has received numerous honors.

Ferdinand F. E. Kopecky has left the Bakelite Corp. to join the staff of the Ellis-Foster Laboratories, Montclair, N. J.

Stanley H. Ellis, until recently with the Barrett Co., has been appointed assistant to the manager of the ammonia division of the Hydrocarbon Co.

James Otis Handy has opened a consulting office for chemical and metallurgical research at 50 E. 41st St., New York, N. Y.

Willis R. Whitney, organizer and for 32 years, director of the research laboratories of the General Electric Co., retired from that position owing to poor health on Nov. 1. By appointment of Gerard Swope, president of the company, he was succeeded by Dr. William David Coolidge, senior associate director of the laboratory. Dr. Whitney continues as vice-president in general charge of research.

George L. Clark, of the University of Illinois, was recently awarded the Grasselli Medal for his work on X-ray research as applied to chemical problems and for papers presented on the subject. Roscoe H. Gerke outlined the accomplishments of the medalist and A. E. Marshall made the presentation of the medal to Dr. Clark.

F. W. Hooper, formerly chemist of the Pacific Mills, Ltd., Ocean Falls, B. C., has joined the staff of the Ross Engineering Co. of Canada, Montreal, P.Q. He will be engaged on sales and engineering service work.

James W. Kellogg, director, Bureau of Foods and Chemistry, Harrisburg, Pa., has been elected president of the Association of Official Agricultural Chemists for the coming year. R. Harcourt, chemist, Ontario Experimental Station, Guelph, is the new vice-president, and W. W. Skinner, of the

DR. IRVING LANGMUIR RECEIVES NOBEL PRIZE

Bureau of Chemistry and Soils was re-elected secretary and treasurer.

J. I. Banash, consulting chemical engineer, was chosen president of the National Safety Council at the recent congress and exposition in Washington, D. C.

Carl Iddings has joined the technical staff of The Muralo Co., Staten Island, N. Y. He will develop new products and processes.

CALENDER

American Institute of Chemical Engineers, annual meeting, Washington, D. C., Dec. 7-9.

National Exposition of Power and Mechanical Engineering, New York, Dec. 5-10.

American Chemical Society, 85th meeting, Washington, D. C., March 26-April 1.

Electrochemical Society, spring meeting, Montreal, May 11-13.

American Society for Testing Materials, Chicago, Ill., June 26-30, 1933.

Fourteenth Exposition of Chemical Industries, New York, week of Dec. 4-9, 1933.

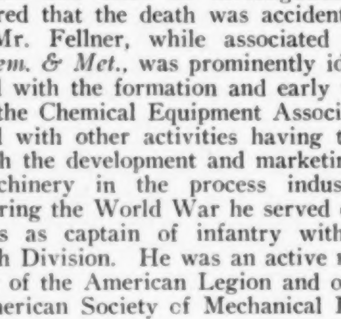
OBITUARY

Henry S. Chatfield, vice-president and sales manager of The Mac-Lac-Kasbier-Chatfield Corp., died on October 27 of pneumonia at his home in Elizabeth, N. J., after one week's illness. He was born in New York City and was brought to Elizabeth as a small boy by his parents. Chatfield prepared for Princeton but did not enter, preferring to study chemistry privately. He organized the United Shellac Importers Association in 1912 and served it as president. When this country entered the World War, President Wilson appointed Mr. Chatfield a member of the Federal board on the regulation of imports and exports. The chemical industries are indebted to him for the achievement of inducing Congress to authorize tax-free denatured alcohol for the use of the industry. He was chairman of the Industrial Alcohol Commission at his death.

Irving Fellner, business manager of *Chem. & Met.*, 1921-1927, and subsequently associated in a similar capacity with *Power* and other McGraw-Hill publications, met his death, October 30, at Chappaqua, N. Y. He had been engaged in target practice that afternoon, using a .45 calibre automatic pistol, and was cleaning this in the kitchen of his home in the evening, when it was discharged. The family physician, Dr. H. E. Robinson, was summoned to the house and after an investigation declared that the death was accidental.

Mr. Fellner, while associated with *Chem. & Met.*, was prominently identified with the formation and early work of the Chemical Equipment Association and with other activities having to do with the development and marketing of machinery in the process industries. During the World War he served overseas as captain of infantry with the 30th Division. He was an active member of the American Legion and of the American Society of Mechanical Engineers.

HENRY S. CHATFIELD



Chemical Exports to Canada Reflect Slower Industrial Operations

CHEMICALS and related products are especially affected by the changes in import duties which became effective Oct. 13 on goods entering Canada. Widening of the differentials between general and preferential rates, makes it evident that Canada plans to supplant imports from the United States partly by expansion of Canadian chemical manufacture and partly by giving preference to goods made in Great Britain or in other British possessions.

In 1929 exports of chemicals and related products from this country to Canada were valued at $25,268,701. Following the general trend of business and of values, this trade was reported at $22,060,574 for 1930 and at $19,109,309 for 1931. Broken down according to Department of Commerce subdivisions, comparisons for the three years show the following:

3,424,306 lb. valued at $497,825 which increased in 1930 to 6,097,362 lb. valued at $667,884. This represents a gain for the year of more than 78 per cent in volume and of more than 34 per cent in value. In 1931 the total was 6,068,996 lb. with an increase in value to $733,388.

In the industrial chemical group, official figures reveal that Canada has been our largest buyer of silicate of soda, sulphate of alumina, and calcium chloride. Canada also holds a prominent place in our export trade in alkalis with shipments in 1929 amounting to 40,501,464 lb. and an increase to 42,073,927 lb. in 1930. In 1931 these shipments fell off but reached a total of 36,536,047 lb. This does not include a total of 5,438,979 lb. of phosphate of soda which was shipped that year. There was no separate listing of phosphate of soda in the preceding years.

Domestic Exports of Chemicals and Related Products to Canada, 1929-1931

	1929	1930	1931
Coal-tar products	$2,083,803	$1,902,486	$1,459,136
Industrial chemical specialties	2,445,015	2,794,327	3,621,612
Medical and pharmaceutical preparations	1,355,196	1,133,583	974,000
Industrial chemicals	9,362,223	7,345,493	6,301,361
Paints, pigments, and varnishes	4,743,532	3,513,472	2,439,347
Fertilizer and fertilizer materials	2,777,117	3,373,927	2,699,778
Explosives, fuses, etc.	302,371	111,666	100,075
Soap and toilet preparations	2,199,444	1,885,620	1,514,000
Totals	$25,268,701	$22,060,574	$19,109,309

In the coal-tar group, a large part of the total is made up of dyes with crudes next in importance. Industrial chemical specialties include insecticides, fungicides, disinfectants, etc., and the growth of this business is illustrated by the fact that the total involved in 1929 was

Total shipments of sodium compounds to Canada in 1929 were 318,658,725 lb., in 1930, 154,920,434 lb., and in 1931, 136,771,985 lb. It is believed that shipments classed as "other sodas" in 1929 included large amounts of sodium sulphate as our exports to Canada were large during that year and the official records show only 2,493,285 lb. as our contribution to Canada for that year. In 1930 shipments of sodium sulphate are listed at 7,569,631 lb. and for 1931 the records show 6,530,693 lb. of sulphate and 26,658,437 lb. of bisulphate.

Incidentally the development of natural salt cake deposits in Canada has made it unnecessary to import this material in as large volume as in recent years.

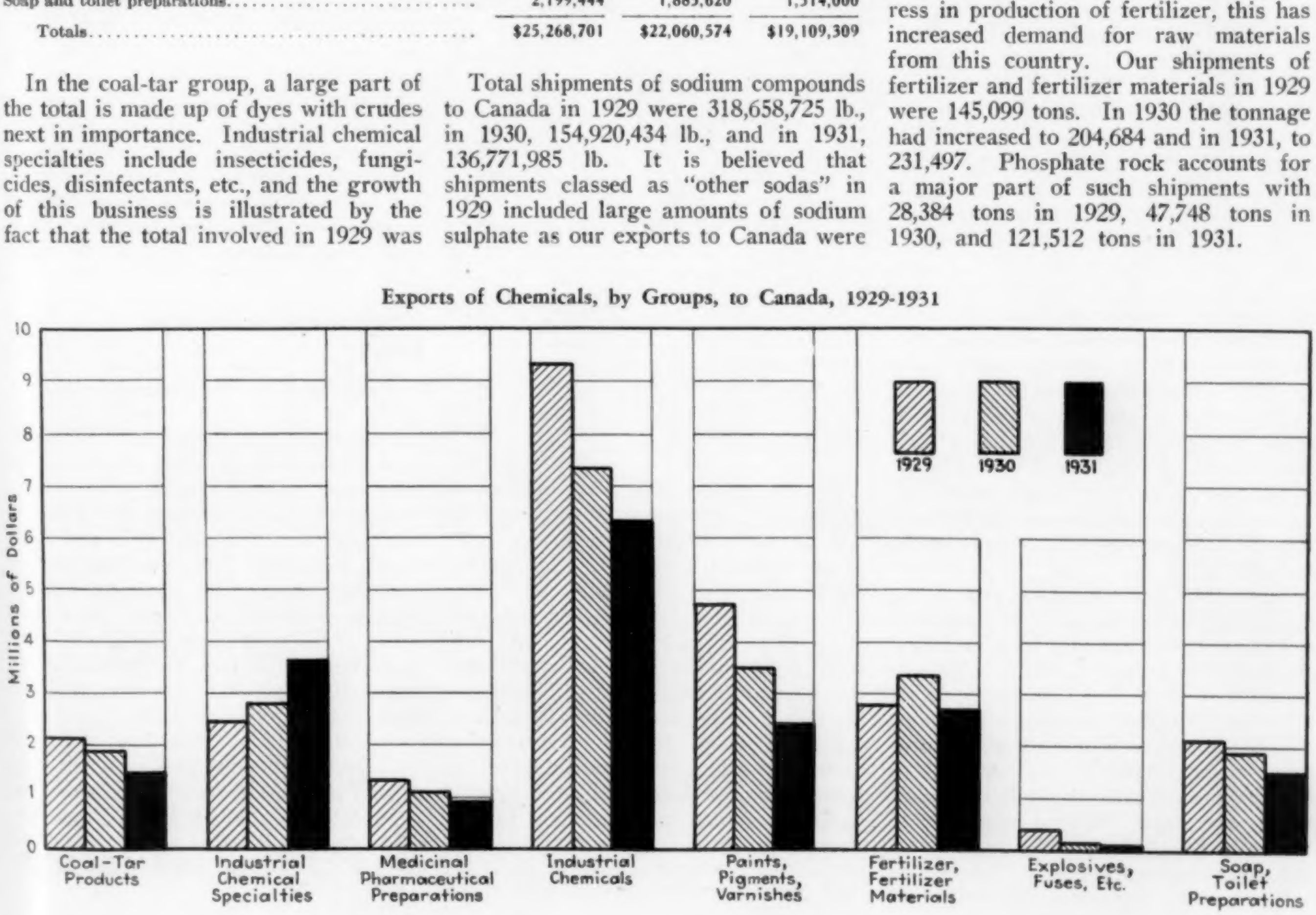
Our export trade with Canada in potassium compounds, not including fertilizer materials, is not large and has been on a declining scale in the last three years, the figures being 1,117,072 lb. for 1929, 876,387 lb. for 1930, and 835,516 lb. for 1931.

Contrary to the trend of general business, domestic shipments of calcium chloride to Canada have been of an increasing nature. In 1929 our shipments were reported at 29,000,402 lb. which were increased to 39,670,238 lb. in 1930 and last year the total was extended to 46,960,995 lb.

Comparisons of trade with Canada in paints, pigments, and varnishes show a steady decline in the last three years from a standpoint of values but the lower prices which prevailed make it evident that the yearly declines were not so large in volume as in value.

While Canada has been making progress in production of fertilizer, this has increased demand for raw materials from this country. Our shipments of fertilizer and fertilizer materials in 1929 were 145,099 tons. In 1930 the tonnage had increased to 204,684 and in 1931, to 231,497. Phosphate rock accounts for a major part of such shipments with 28,384 tons in 1929, 47,748 tons in 1930, and 121,512 tons in 1931.

Exports of Chemicals, by Groups, to Canada, 1929-1931



CHEMICAL ECONOMICS

Sharp increase in output of chemicals in October. Broader productive activities reported for different branches of the industry. Different consuming trades take on larger stocks of raw materials with textiles and rayon still holding first position

OPERATIONS on the part of plants producing chemicals were speeded up considerably in October if consumption of electrical power offers a reliable basis of computation. From total figures of power consumed the index number for chemical production in October was 119.8 which compares with 110.7 for September and 110.1 for August. The reports from different branches of the industry infer that gains in output have been fairly general and have not been confined to a few lines. It is further reported that improvement has not been sectionally confined but that greater activities have been found in all sections of the country.

The position of consuming industries likewise has been bettered and enlarged production has resulted because of the larger amounts of raw materials taken by these consuming branches. In the case of textiles and rayon the gain in trade in the last two months has been noteworthy. In the case of most other industries, gains have been merely a recovery from the low level to which trading had descended in the preceding months.

Some let-down in textile operations has been noted in the present month but rayon producers are said to be working at 100 per cent capacity which at present plant capacities would probably mean about 15,000,000 lb. of yarn a month or a new record for production. Moreover, rayon production is expected to hold its present pace through December with operations beyond that time naturally dependent on the position of the consuming market.

Comparative figures of production and consumption for October are not yet available but the state of business in September in comparison with the preceding month may be traced from the following figures:

Production	1932 September	1932 August
Arsenic, crude, ton	1,992	2,299
Arsenic, refined, ton	720	943
Automobile, no.	84,141	90,324
Byproduct coke, 1,000 tons	1,544	1,474
Explosives, 1,000 lb.	19,938	18,340
Glass containers, 1,000 gr.	1,162	1,660
Plate glass, 1,000 sq.ft.	3,406	1,773
Acetate of lime, 1,000 lb.	1,563	1,179
Methanol, refined, gal.	102,448	150,686
Methanol, crude, gal.	98,108	98,872
Methanol, synthetic, gal.	697,890	792,641
Pyroxylin spread, 1,000 lb.	2,403	1,959
Cottonseed oil, crude, 1,000 lb.	173,198	45,539
Cottonseed oil, refined, 1,000 lb.	81,183	38,273
Pine oil, gal.	231,115	189,132
Rosin, wood, bbl.	31,155	31,141
Turpentine, wood, bbl.	5,020	4,861
Rosin, gum, receipts at 3 ports, bbl.	83,484	99,148
Turpentine, gum, receipts at 3 ports, bbl.	22,811	27,770
Consumption		
Cotton, in textiles, 1,000 bales	492	403
Wool, 1,000 lb.	46,055	41,361
Silk, bales	59,694	59,905
Rubber, ton	20,692	20,582
Fertilizer, in south, 1,000 tons	97	40

The figures for plate glass production do not cover the entire industry and on that account are not comparable with those reported for 1931. The totals for consumption of cotton, wool, and silk bear out reports of larger textile production. Trade reports say that print cloth production in October ran about 8 per cent over that of September but that a decline occurred in the case of silk and woolen goods. The government report on cotton as published in November gave a set-back to buying of cotton goods and may affect the rate of production.

Factory production of fats and oils, exclusive of refined oils and derivatives, during the three months ended Sept. 30, was as follows: Vegetable oils, 418,363,324 lb.; fish oils, 36,721,856 lb.; animal fats, 474,719,323 lb.; and greases, 74,640,027 lb.—a total of 1,044,444,530 lb.

Of the several kinds of fats and oils the largest production, 345,512,386 lb., appears for lard. Next in order is cottonseed, with 249,475,730 lb.; tallow 127,160,315 lb.; linseed oil, 68,502,774 lb.; cocoanut oil, 53,014,939 lb.; corn oil, 27,393,923 lb.; castor oil, 8,467,383 lb.; soya bean oil, 5,404,909 lb.

Production of refined oils during the period was as follows: Cottonseed, 173,568,801 lb.; cocoanut, 57,349,518 lb.; peanut, 1,902,959 lb.; corn oil, 26,191,893 lb.; soya bean, 4,834,759 lb., and palm kernel, 1,609,036 lb.

Foreign trade in chemicals

Foreign trade in chemicals which has been on a downward scale is not improved in outlook by the recent action taken by Canada to give preference to British goods.

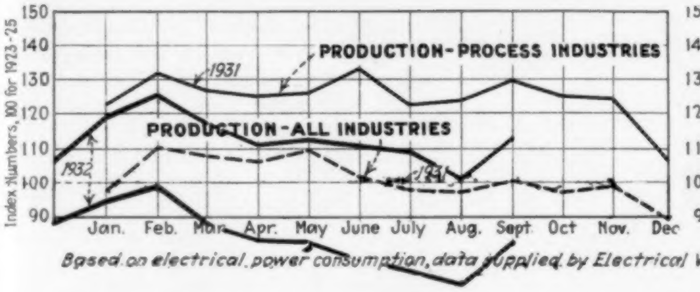
Export figures for September indicate that large amounts of methanol and butyl alcohol are figuring in foreign commerce. Sulphate of alumina was shipped out in a large way in September. Exports of sodium compounds in that month were 30,114,836 lb. with bichromate and phosphate alone showing gains over the movement in September last year. Export shipments of fertilizer and fertilizer materials fell from 127,953 tons in September, 1931, to 64,686 tons last September.

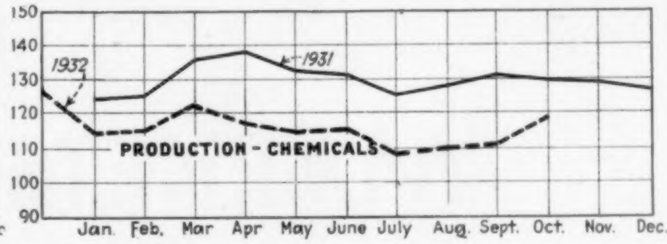
Import trade in chemicals in September was featured by large arrivals of creosote oil, acetic acid, chlorate of potash, and sulphate of ammonia. By way of contrast, exports of sulphate of ammonia in September amounted to 3 tons while imports were 33,995 tons.

Production of Arsenic In 1931

Production of arsenic as arsenious oxide in the United States in 1931 amounted to 17,137 short tons, of which most (14,482 tons) was refined and the remainder (2,655 tons) was crude, Bureau of Mines, announces. The entire output in 1931, as in 1929 and 1930, was a byproduct from smelting copper and lead ores. The products for the market consisted of refined white arsenic, crude white arsenic, "black" dust and "treater" dust. No production of red arsenic sulphide or elemental arsenic was reported in 1931.

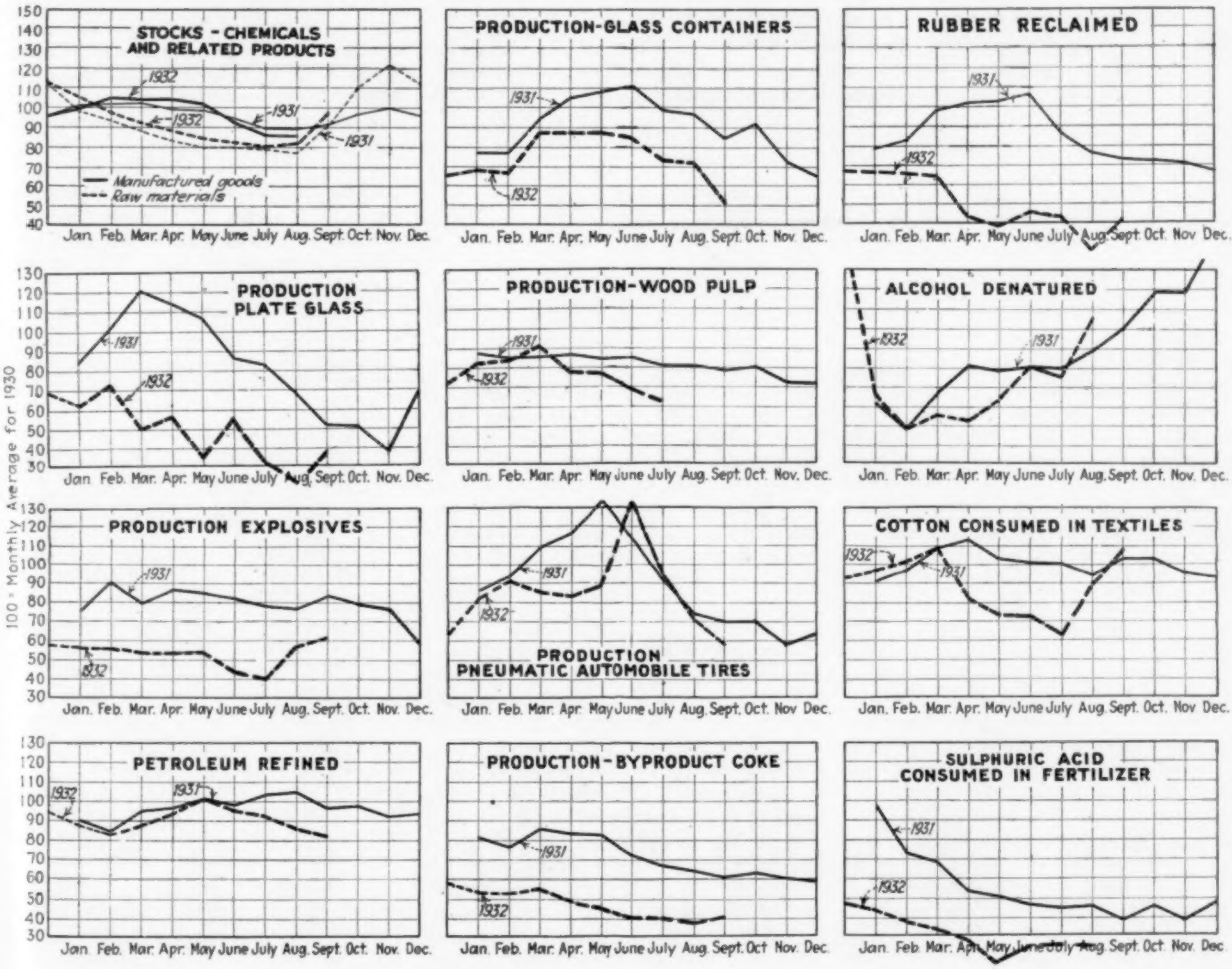
A total of 13,777 short tons of refined and crude arsenic was sold; it was valued at $796,744 (2.9c. a lb.). The refined white arsenic, 11,982 tons, was sold for $718,386 (3c. a lb.); the crude arsenic, 1,795 tons, was sold for $78,358 (2.18c. a lb.).

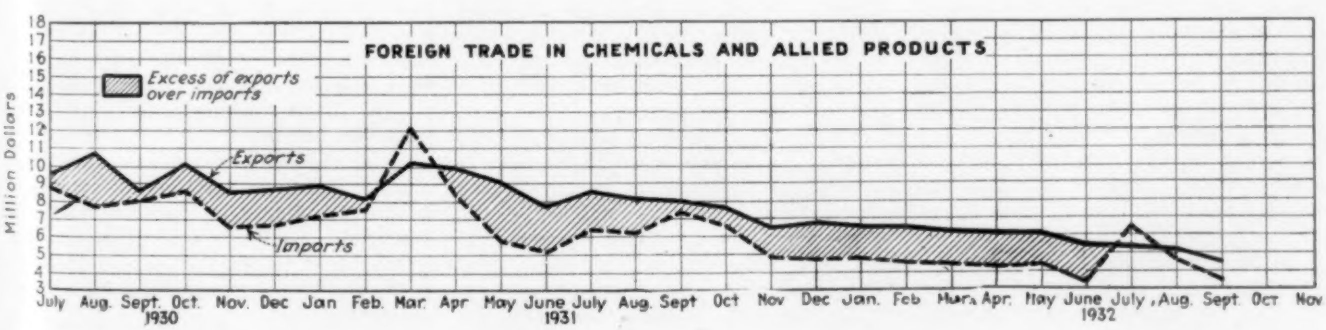




Based on electrical power consumption, data supplied by Electrical World

TRENDS OF PRODUCTION AND CONSUMPTION





MARKETS

New contract prices awaited for alkalis and other heavy chemicals. Spot trading shows improvement but some consuming industries fail to increase commitments. Reorganization of Chilean nitrate of soda industry forecast. Norway attempts to develop domestic and export trade in sulphur produced from pyrites. Canada will increase facilities for producing vegetable oils

CONTRACT orders for 1933 delivery have been common in some cases but alkalis and some of the other heavy chemicals have not been generally quoted for future positions and interest has been gaining regarding the price levels which will prevail for next year's delivery. Spot business has shown improvement as far as certain consumers are concerned but other buyers have been disappointing and gains can not be described as anything better than seasonal.

Announcements of government plans to reorganize the nitrate of soda industry in Chile have come from unofficial sources. Nothing definite has come to light but proposed plans are said to contemplate an absolute government control and interest has been aroused regarding the investments of American and other capitalists in the Chilean industry. Recent advices state that the largest nitrate plant in Chile has been closed.

For some time negotiations have been pending regarding financial readjustment of the existing nitrate organization. Press despatches say a special commission will be appointed to liquidate the old organization in such a way that a more favorable financial set-up may be arranged.

Attempts on the part of Canada to increase its production of chemicals under protection of higher tariffs apparently are being extended to vegetable oil production as well. A new plant for production of soya bean oil at Chatham, Ont., is being put into operation under the management of the Archer-Daniels-Midland Co. of Minneapolis. It is also reported that Canadian Vegetable Oils, Limited, will erect a plant on Burrad Inlet, Vancouver, and work on the first unit, which will cost $45,000, is expected to commence within a few weeks. The factory will produce crude vegetable oils and sacked oil meals from soy beans, peanuts and copra.

Sulphur developments

Negotiation for the reorganization of the Sicilian Sulphur Consortium, which got under way in Rome early in October at the call of the Italian government, have been temporarily suspended, according to reports to the Department of Commerce. Prevention of further adverse developments since the dissolution of the consortium, July 31, 1932, has been the principle objective of the reorganization proposals made by the Italian government.

Recent reports that new production of sulphur was to get underway at Jefferson Lake, La., have been followed by reports that one of the large domestic producing companies may develop a sulphur deposit in Louisiana at Lake Washington salt dome about 40 miles south of New Orleans.

The U. S. commercial attache at Oslo reports that a new plant in Norway is producing sulphur from pyrites by the Orkla Gruber process and while the plant is not yet in full production it is supplying Norwegian customers and also is offering for export.

Development of natural salt cake deposits in Canada has cut down domestic exports to that country but interest in salt cake was stimulated in the last few weeks by reports that a new plant for sodium sulphate production would be erected in Norway and that the Ozark Chemical Co. of Tulsa, Okla., would construct a plant near Monahans, Texas to recover sodium sulphate from the waters of Soda Lake.

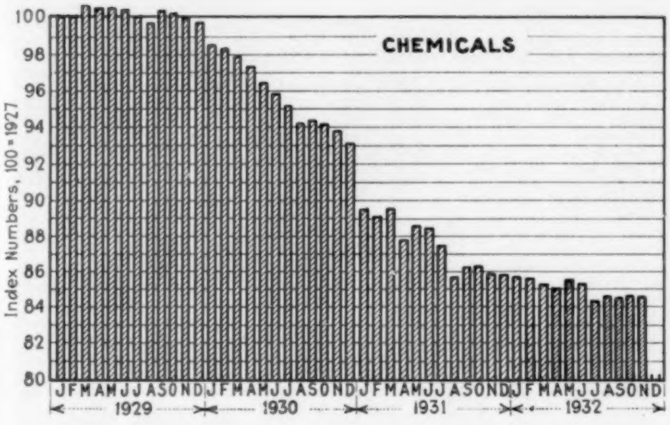
Reports from Japan say that notwithstanding the decline in production of Japanese bleaching powder as shown by official figures (metric tons): 1929—55,085; 1930—44,293; 1931—36,579; Jan.-May, 1932—15,895; the marketing problems of the industry continued. It is now stated in unofficial sources a central sales organization representing some 10 firms is to distribute the products of these concerns. Besides bleaching powder the chief chemicals are caustic soda, chlorine, peroxides, ammonium chloride, hydrochloric acid, sodium chlorate and cyanide, hydrogen, etc. In the case of bleaching powder there is still in effect a 55 per cent production curtailment agreement of the producers association.

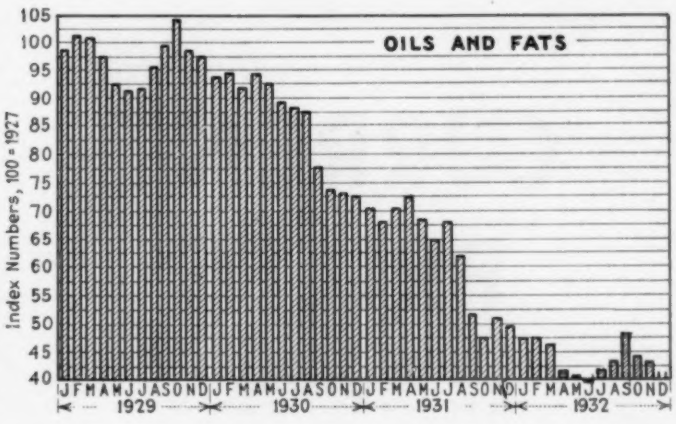
A firmer market for mercury was reported in the last two weeks with the main development of the month found in an arrival of 3,553 flasks from Alicante, Spain. This material was part of an old contract placed by an American company and is to be used in the installation of mercury boilers. At present prices mercury is not on an import basis and domestic production is in control of the market.

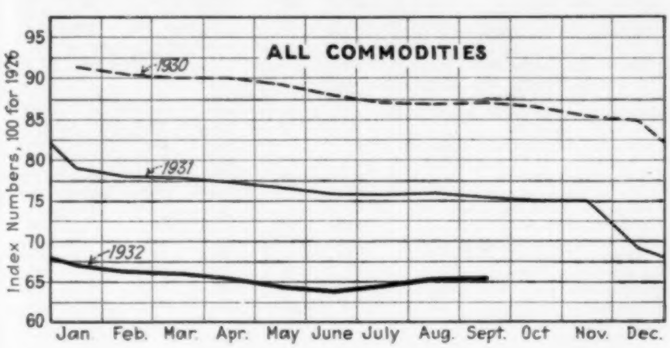
Competition from foreign markets has been of a disturbing nature in some cases and has brought forth numerous requests for anti-dumping orders. The drop in foreign exchange, however, has been a factor in increasing foreign competition and recourse to anti-dumping provisions not only suffers from delays but also because of the difficulty in obtaining proof of charges. It is probable that revision will be sought for our present anti-dumping laws so that they may be made more effective.

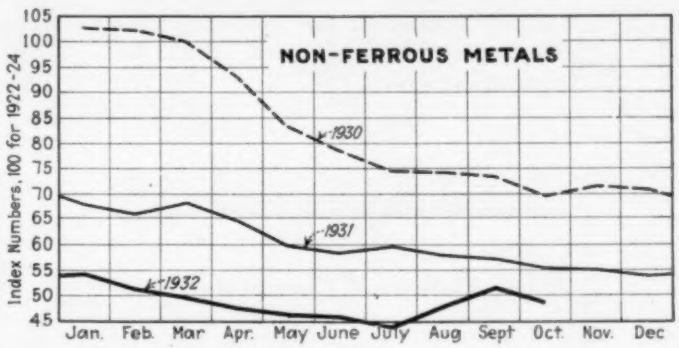
A hearing on charges of dumping stearic acid by Holland and Russia was held in Washington on Oct. 26. Counsel for domestic producers declared that stearic acid from Russia, is sold at a price of 3.2c. per lb. and imports from the Netherlands at 4.8c. per lb. The domestic industry cannot begin to produce the product and sell it at such prices. Domestic production cost averages 7½c. per lb.

After the hearing announcement was made that instructions would go forward to customs collectors directing them to withhold further appraisements of stearic acid imports from the Netherlands pending investigation of alleged dumping.









PRICE TRENDS—CHEM. & MET.'S WEIGHTED INDEXES

MEASURED by the movement of the weighted index number, the price level for chemicals in the last month varied but slightly. The undercurrent, however, was less firm than in the preceding month. Reductions in other commodities, vegetable oils, animal fats, non-ferrous metals, etc., appeared to have a sympathetic influence and buying interest did not appear in volume enough to cause any strengthening. In some cases, phosphates of soda for instance, there has been competition among sellers which has unsettled values. In general, the market has been featured by an absence of price-cutting and this has been a very important factor in holding price changes at a minimum.

A large part of contract orders for next year is yet to be placed and apparently both buyers and sellers have been content to defer action. Undoubtedly the coming month will bring contract buying into greater prominence and will furnish an opportunity for testing the strength of the market.

While import statistics record a slower movement of foreign chemicals to domestic markets, the disturbance to prices which has resulted from foreign competition in many products can not be minimized. The long list of commodities on which investigations or dumping orders have been requested is proof of the seriousness of this situation. Depreciated foreign currencies place many foreign countries in a favorable position to export to this country and emphasize the importance of domestic valuations as a basis for levying import duties.

With the general level of prices reduced to present standards there is not much incentive to drive values lower and while selling pressure here and there may make itself felt, it is not probable that any material fluctuations will be experienced. On the other hand it is not anticipated that consuming demand will take on unusually large proportions in the near future and it will take a sustained active buying movement to start prices on an upward trend. The price position will be considerably clarified when contract prices for all commodities have been made public and when the degree of adherence to those prices likewise is known.

Naval stores have been rather unstable in price with values fluctuating according to demand. Fundamental conditions, however, have been improving and long-time views favor higher prices.

Linseed oil moved up in price in the last month and while demand has not been unusually heavy, the low prices prevailing for cake and meal and the relatively low supply of seed have created a situation which is in favor of a strong market. Other vegetable oils have lacked strength during the period. In most cases there has been a large visible supply and consumers have not felt it necessary to enlarge purchases.

Chem. & Met. Weighted Index of Chemical Prices

Base = 100 for 1927

This month	**84.61**
Last month	84.63
November, 1931	85.98
November, 1930	93.82

Price changes in chemicals during the past month were unimportant. Basic chemicals underwent no change. Nitrate of soda was quoted at a premium but lower average prices prevailed for turpentine and open cuts were made in prices for cream of tartar and di-basic phosphate of soda.

Chem. & Met. Weighted Index of Prices for Oils and Fats

Base = 100 for 1927

This month	**43.15**
Last month	44.51
November, 1931	50.99
November, 1930	73.09

Linseed oil increased in value during the month but most other vegetable oils showed a declining price tendency. Animal fats also were offered at lower prices and the weighted index number registered a material drop from that of a month ago.

CURRENT PRICES

The following prices refer to round lots in the New York market. Where it is the trade custom to sell f.o.b. works, quotations are given on that basis and are so designated. Prices are corrected to Nov. 13.

Industrial Chemicals

	Current Price	Last Month	Last Year
Acetone, drums, lb	$0.10 –$0.11	$0.10 –$0.11	$0.10 –$0.11
Acid, acetic, 28%, bbl., cwt	2.65 – 2.90	2.65 – 2.90	2.50 – 2.75
Glacial 99%, tanks	8.89	8.89 –	8.10 –
drs	9.14 – 9.39	9.14 – 9.39	8.35 – 8.60
U. S. P. reagent, c'bys	9.64 – 9.89	9.64 – 9.89	8.85 – 9.10
Boric, bbl., lb	.04¾– .05	.04¾– .05	.06¾– .07
Citric, kegs, lb	.29 – .31	.29 – .31	.35 – .36
Formic, bbl., lb	.10 – .11	.10 – .11	.10 – .11
Gallic, tech., bbl., lb	.50 – .55	.50 – .55	.50 – .55
Hydrofluoric 30% carb., lb	.06 – .07	.06 – .07	.06 – .07
Latic, 44%, tech., light, bbl., lb	.11½– .12	.11½– .12	.11½– .12
22%, tech., light, bbl., lb	.05½– .06	.05½– .06	.05½– .06
Muriatic, 18° tanks, cwt	1.00 – 1.10	1.00 – 1.10	1.00 – 1.10
Nitric, 36°, carboys, lb	.05 – .05½	.05 – .05½	.05 – .05½
Oleum, tanks, wks., ton	18.50 –20.00	18.50 –	18.50 –20.00
Oxalic, crystals, bbl., lb	.11 – .11½	.11 – .11½	.11 – .12
Phosphoric, tech., c'bys., lb	.08½– .09	.08½– .09	.08½– .09
Sulphuric, 60°, tanks, ton	11.00 –11.50	11.00 –11.50	11.00 –11.50
Sulphuric, 66°, tanks, ton	15.50 –	15.50 –	15.50 –
Tannic, tech., bbl., lb	.23 – .35	.23 – .35	.23 – .35
Tartaric, powd., bbl., lb	.22 – .22½	.22 – .22½	.26½– .27½
Tungstic, bbl., lb	1.40 – 1.50	1.40 – 1.50	1.40 – 1.50
Alcohol, ethyl, 190 p'f., bbl., gal	2.53½–	2.53½–	2.33 –
Alcohol, Butyl, tanks, lb	.113 –	.113–	.14½–
Alcohol, Amyl	–	–	–
From Pentane, tanks, lb	.182–	.182–	.203
Denatured, 190 proof			
No. 1 special dr., gal	.34½–	.34½–	.28 –
No. 5, 188 proof, dr., gal	.38½–	.38½–	.28 –
Alum, ammonia, lump, bbl., lb	.03 – .04	.03 – .04	.03¼– .04
Chrome, bbl., lb	.04½– .05	.04½– .05	.04½– .05
Potash, lump, bbl., lb	.03 – .04	.03 – .04	.03¼– .04
Aluminum sulphate, com., bags, cwt	1.25 – 1.40	1.25 – 1.40	1.25 – 1.40
Iron free, bg., cwt	1.90 – 2.00	1.90 – 2.00	1.90 – 2.00
Aqua ammonia, 26°, drums lb.	.02½– .03	.02¾– .03	.02¾– .03
tanks, lb.	.02½– .02¾	.02½– .02¾	.02½– .02¾
Ammonia, anhydrous, cyl., lb	.15¼– .15½	.15½– .15½	.15½– .15½
tanks, lb	.05 –	.05¾–	.05¾–
Ammonium carbonate, powd. tech., casks, lb	.10 – .11	.10 – .11	.10½– .11
Sulphate, wks., cwt	1.025–	1.025–	1.10 –
Amylacetate tech., tanks, lb., gal	.16 –	.16 –	.16½
Antimony Oxide, bbl., lb	.07 – .08	.07 – .08	.08 – .09
Arsenic, white, powd., bbl., lb	.04 – .04½	.04 – .04½	.04 – .04½
Red, powd., kegs, lb	.09 – .10	.09 – .10	.09 – .10
Barium carbonate, bbl., ton	56.50 –58.00	56.50 –58.00	56.50 –58.00
Chloride, bbl., ton	63.00 –65.00	63.00 –65.00	63.00 –65.00
Nitrate, cask, lb	.07½– .07½	.07 – .07½	.07 – .07½
Blanc fixe, dry, bbl., lb	.03½– .04	.03½– .04	.03¾– .04
Bleaching powder, f.o.b., wks., drums, cwt	1.75 – 2.00	1.75 – 2.00	2.00 – 2.10
Borax, grain, bags, ton	40.00 –45.00	40.00 –45.00	50.00 –57.00
Bromine, cs., lb	.36 – .38	.36 – .38	.36 – .38
Calcium acetate, bags	2.50 –	2.50 –	2.00 –
Arsenate, dr., lb	.05½– .06½	.05½– .06½	.06 – .07
Carbide drums, lb	.05 – .06	.05 – .06	.05 – .06
Chloride, fused, dr., wks., ton	18.00 –	18.00 –	20.00 –
flake, dr., wks., ton	21.00 –	21.00 –	22.75 –
Phosphate, bbl., lb	.07½– .08	.08 – .08½	.08 – .08½
Carbon bisulphide, drums, lb	.05 – .06	.05 – .06	.05 – .06
Tetrachloride drums, lb	.06½– .07	.06½– .07	.06½– .07
Chlorine, liquid, tanks, wks., lb	.0155 –	.0155–	.01¾–
Cylinders	.04 – .06	.04 – .06	.04 – .06
Cobalt oxide, cans, lb	1.25 – 1.35	1.25 – 1.35	1.35 – 1.45

	Current Price	Last Month	Last Year
Copperas, bgs., f.o.b. wks., ton	13.00 –14.00	13.00 –14.00	13.00 –14.00
Copper carbonate, bbl., lb	.07 – .16	.07 – .16	.08½– .18
Cyanide, tech., bbl., lb	.39 – .44	.39 – .44	.41 – .46
Sulphate, bbl., cwt	3.00 – 3.25	3.00 – 3.25	3.40 – 3.60
Cream of tartar, bbl., lb	.16½– .17	.17 – .17½	.21¾– .22
Diethylene glycol, dr., lb	.14 – .16	.14 – .16	.14 – .16
Epsom salt, dom., tech., bbl., cwt	1.70 – 2.00	1.70 – 2.00	1.70 – 2.00
Imp., tech., bags, cwt	1.15 – 1.25	1.15 – 1.25	1.15 – 1.25
Ethyl acetate, drums, lb	.10 –	.10 –	.06½–
Formaldehyde, 40%, bbl., lb	.06 – .07	.06 – .07	.06 – .07
Furfural, dr., contract, lb	.10 – .17½	.10 – .17½	.10 – .17½
Fusel oil, crude, drums, gal	1.10 – 1.20	1.10 – 1.20	1.10 – 1.20
Refined, dr., gal	1.80 – 1.90	1.80 – 1.90	1.80 – 1.90
Glaubers salt, bags, cwt	1.00 – 1.10	1.00 – 1.10	1.00 – 1.10
Glycerine, c.p., drums, extra, lb	.10¼– .10½	.10¼– .10½	.11½– .12
Lead:			
White, basic carbonate, dry casks, lb	.06½–	.06½–	.07½–
White, basic sulphate, sck., lb	.06 –	.06 –	.07 –
Red, dry, sck., lb	.06¾–	.06¾–	.07½–
Lead acetate, white crys., bbl., lb	.10 – .11	.10 – .11	.10 – .11
Lead arsenate, powd., bbl., lb	.09½– .14	.09½– .14	.10 – .14
Lime, chem., bulk, ton	8.50 –	8.50 –	8.50 –
Litharge, pwd., csk, lb	.05¾–	.05¾–	.06½–
Lithophone, bags, lb	.04½– .05	.04½– .05	.04½ .05
Magnesium carb., tech., bags, lb	.05¾– .06	.05¾– .06	.06 – .06½
Methanol, 95%, tanks, gal	.33 –	.33 –	.33 –
97%, tanks, gal	.34 –	.34 –	.34 –
Synthetic, tanks, gal	.35½–	.35½–	.35½–
Nickel salt, double, bbl., lb	.10½– .11	.10½– .11	.10½– .11
Orange mineral, csk., lb	.09¼–	.09¼–	.09½–
Phosphorus, red, cases, lb	.42 – .44	.42 – .44	.42 – .44
Yellow, cases, lb	.28 – .32	.28 – .32	.31 – .32
Potassium bichromate, casks, lb	.08 – .08½	.08 – .08½	.09 – .09¼
Carbonate, 80-85%, calc. csk., lb	.05 – .05½	.05 – .05½	.05¼– .06
Chlorate, powd., lb	.08 – .08½	.08 – .08½	.08 – .08½
Hydroxide (c'stic potash) dr., lb	.06½– .06¾	.06½– .06¾	.06½– .06¾
Muriate, 80% bgs., ton	37.15 –	37.15 –	37.15 –
Nitrate, bbl., lb	.05½– .06	.05¼– .06	.05¼– .06
Permanganate, drums, lb	.16 – .16½	.16 – .16½	.16 – .16½
Prussiate, yellow, casks, lb	.18½– .19½	.18½– .19	.18½– .19
Sal ammoniac, white, casks, lb	.04½– .05	.04½– .05	.04½– .05
Salsoda, bbl., cwt	.90 – .95	.90 – .95	.90 – .95
Salt cake, bulk, ton	13.00 –15.00	13.00 –15.00	16.00 –18.00
Soda ash, light, 58%, bags, contract, cwt	1.15 –	1.15 –	1.15 –
Dense, bags, cwt	1.17½–	1.17½–	1.17½–
Soda, caustic, 76%, solid, drums, contract, cwt	2.50 – 2.75	2.50 – 2.75	2.50 – 2.75
Acetate, works, bbl., lb	.05 – .06	.05 – .06	.05 – .05½
Bicarbonate, bbl., cwt	1.85 – 2.00	1.85 – 2.00	1.85 – 2.00
Bichromate, casks, lb	.05 – .06	.05 – .06	.06½– .07
Bisulphate, bulk, ton	14.00 –16.00	14.00 –16.00	14.00 –16.00
Bisulphite, bbl., lb	.03¾– .04	.03¾– .04	.03½– .04
Chlorate, kegs, lb	.05¾– .07½	.05¾– .07½	.05¾– .07½
Chloride, tech., ton	12.00 –14.75	12.00 –14.75	12.00 –14.00
Cyanide, cases, dom., lb	.15½– .16	.15½– .16	.16½– .17
Fluoride, bbl., lb	.07½– .08	.07½– .08	.07½– .08
Hyposulphite, bbl., lb	2.40 – 2.50	2.40 – 2.50	2.40 – 2.50
Nitrate, bags, cwt	1.27 –	1.245–	1.77 –
Nitrite, casks, lb	.07¼– .08	.07¼– .08	.07¼– .08
Phosphate, dibasic, bbl., lb	.018– .02	.0255–	.0265 – .03
Prussiate, yel. drums, lb	.11½– .12	.11½– .12	.11½– .12
Silicate (30°, drums), cwt	.60 – .70	.60 – .70	.60 – .70
Sulphide, fused, 60-62%, dr., lb	.02¾– .03½	.02¾– .03	.02¾– .03
Sulphite, cyrs., bbl., lb	.03 – .03¾	.03 – .03¾	.03 – .03½
Sulphur, crude at mine, bulk, ton	18.00 –	18.00 –	18.00 –
Chloride, dr., lb	.03½– .04	.03½– .04	.05 – .06
Dioxide, cyl., lb	.06½– .07	.06½– .07	.06½– .07
Flour, bag, cwt	1.55 – 3.00	1.55 – 3.00	1.55 – 3.00
Tin bichloride, bbl., lb	nom.–	nom.–	nom.–
Oxide, bbl., lb	.27½–	.27 –	.26
Crystals, bbl., lb	.24 –	.24 –	.24½–
Zinc chloride, gran., bbl., lb	.06½– .06¾	.06½– .06¾	.06½– .06¾
Carbonate, bbl., lb	.10½– .11	.10½– .11	.10½– .11
Cyanide, dr., lb	.38 – .42	.41 – .42	.41 – .42
Dust, bbl., lb	.04½– .06	.04½– .05	.05½– .06
Zinc oxide, lead free, bag, lb	.05¾–	.05¾–	.06¾–
5% lead sulphate, bags, lb	.05½–	.05½–	.06¾–
Sulphate, bbl., cwt	3.00 – 3.25	3.00 – 3.25	3.00 – 3.25

Oils and Fats

	Current Price	Last Month	Last Year
Castor oil, No. 3, bbl., lb	$0.09½–$0.10½	$0.09½–$0.10	$0.10½–$0.11
Chinawood oil, bbl., lb	.05¾–	.06 –	.08¾–
Coconut oil, Ceylon, tanks, N. Y. lb	.03¼–	.03¾–	.03¾–
Corn oil crude, tanks, (f.o.b. mill), lb	.03¼–	.04¼–	.04¼–
Cottonseed oil, crude (f.o.b. mill), tanks, lb.	.03 –	.03½–	.03¾–
Linseed oil, raw car lots, bbl., lb	.067–	.061–	.075–
Palm, Lagos, casks, lb	.03½–	.04 –	.04½
Niger, casks, lb	.03½–	.03½–	.03¾
Palm Kernel, bbl., lb	.04½–	.04½–	.05¼–
Peanut oil, crude, tanks (mill), lb.	.03½–	.03¾–	.05 –
Rapeseed oil, refined, bbl., gal	.33 – .34	.36 – .37	.42 – .44
Soya bean, tank (f.o.b. Coast), lb.	nom.–	nom.–	nom.–
Sulphur (olive foots), bbl., lb	.04½–	.04½–	.04½–
Cod, Newfoundland, bbl., gal	.21 – .26	.21 – .26	.26 – .28
Menhaden, light pressed, bbl., gal.	.27 – .28	.29 – .30	.33 – .34
Crude, tanks (f.o.b. factory), gal.	.09½–	.12 –	.20 –
Grease, yellow, loose, lb	.02½–	.02¾–	.02½–
Oleo stearine, lb	.05½–	.06 –	.06½–
Red oil, distilled, d.p. bbl., lb	.06½–	.06½–	.07½–
Tallow, extra, loose, lb	.02¾–	.03½–	.03¼–

Coal-Tar Products

	Current Price	Last Month	Last Year
Alpha-naphthol, crude, bbl., lb..	\$0.60 -\$0.65	\$0.60 -\$0.65	\$0.60 -\$0.62
Refined, bbl., lb.	.80 - .85	.80 - .85	.80 - .85
Alpha-naphthylamine, bbl., lb..	.32 - .34	.32 - .34	.32 - .34
Aniline oil, drums, extra, lb.	.14½- .15	.14½- .15	.15 - .16
Aniline salts, bbl., lb.	.24 - .25	.24 - .25	.24 - .52
Benzaldehyde, U.S.P., dr., lb.	\$1.10 -\$1.25	\$1.10 -\$1.25	\$1.10 -\$1.25
Benzidine base, bbl., lb.	.65 - .67	.65 - .67	.65 - .67
Benzoic acid, U.S.P., kgs, lb.	.48 - .52	.48 - .52	.48 - .52
Benzyl chloride, tech., dr., lb.	.30 - .35	.30 - .35	.30 - .35
Benzol, 90%, tanks, works, gal..	.20 - .21	.20 - .21	.20 - .21
Beta-naphthol, tech., drums, lb..	.22 - .24	.22 - .24	.22 - .24
Cresol, U. S. P., dr., lb.	.10½- .11	.10½- .11	.12½- .14
Cresylic acid, 97%, dr., wks., gal.	.49 - .52	.49 - .52	.54 - .58
Diethylaniline, dr., lb.	.55 - .58	.55 - .58	.55 - .58
Dinitrophenol, bbl., lb.	.29 - .30	.29 - .30	.29 - .30
Dinitrotoluen, bbl. lb.	.16 - .17	.16 - .17	.16 - .17
Dip oil 25% dr., gal.	.23 - .25	.23 - .25	.26 - .28
Diphenylamine, bbl., lb.	.38 - .40	.38 - .40	.38 - .40
H-acid, bbl., lb.	.65 - .70	.65 - .70	.65 - .70
Naphthalene, flake, bbl., lb.	.04¾- .05	.04¾- .05	.03¾- .04¼
Nitrobenzene, dr., lb.	.08½- .09	.08½- .09	.08½- .10
Para-nitraniline, bbl., lb.	.51 - .55	.51 - .55	.51 - .55
Para-nitrotoluine, bbl., lb.	.26 - .28	.26 - .28	.29 - .31
Phenol, U.S.P., drums, lb.	.14¼- .15	.14¼- .15	.14¼- .15
Picric acid, bbl., lb.	.30 - .40	.30 - .40	.30 - .40
Pyridine, dr., lb.	1.50 - 1.75	1.50 - 1.80	1.50 - 1.80
R-salt, bbl., lb.	.40 - .44	.40 - .44	.40 - .44
Resorcinal, tech., kegs, lb.	.65 - .70	.65 - .70	1.15 - 1.25
Salicylic acid, tech., bbl., lb.	.33 - .35	.33 - .35	.33 - .35
Solvent naphtha, w.w., tanks, gal.	.26 -......	.26 -......	.26 -......
Tolidine, bbl., lb.	.86 - .88	.86 - .88	.86 - .88
Toluene, tanks, works, gal.	.30 -......	.30 -......	.30 -......
Xylene, com., tanks, gal.	.26 -......	.26 -......	.26 -......

Miscellaneous

	Current Price	Last Month	Last Year
Barytes, grd., white, bbl., ton...	\$22.00-\$25.00	\$22.00-\$25.00	\$23.00-\$25.00
Casein, tech., bbl., lb.	.06 - .10½	.06 - .10½	.07½- .14
China clay, dom., f.o.b. mine, ton	8.00 -20.00	8.00 -20.00	8.00 -20.00
Dry colors:			
Carbon gas, black (wks.), lb...	.02¾- .20	.02¾- .20	.03 - .20
Prussian blue, bbl., lb.	.35 - .36	.35 - .36	.35 - .36
Ultramine blue, bbl., lb.	.06 - .32	.06 - .32	.06 - .32
Chrome green, bbl., lb.	.26 - .27	.26 - .27	.27 - .30
Carmine red, tins, lb.	3.90 - 4.50	3.90 - 4.50	5.00 - 5.40
Para toner, lb.	.75 - .80	.75 - .80	.77 - .80
Vermilion, English, bbl., lb.	1.25 - 1.50	1.25 - 1.50	1.55 - 1.60
Chrome yellow, C. P., bbl., lb.	.16 - .16½	.16 - .16½	.16½- .17
Feldspar, No. 1 (f.o.b. N.C.), ton	6.50 - 7.50	6.50 - 7.50	6.50 - 7.50
Graphite, Ceylon, lump, bbl., lb.	.07 - .08½	.07 - .08½	.07 - .08½
Gum copal Congo, bags, lb.	.06 - .08	.06 - .08	.07 - .09
Manila, bags, lb.	.16 - .17	.16 - .17	.16 - .17
Damar, Batavia, cases, lb.	.16 - .16½	.16 - .19	.16 - .16½
Kauri No. 1 cases, lb.	.45 - .48	.45 - .48	.48 - .53
Kieselguhr (f.o.b. N.Y.), ton...	50.00 -55.00	50.00 -55.00	50.00 -55.00
Magnesite, calc, ton.	40.00 -......	40.00 -......	40.00 -......
Pumice stone, lump, bbl., lb.	.05 - .07	.05 - .08	.05 - .07
Imported, casks, lb.	.03 - .40	.03 - .40	.03 - .35
Rosin, H., bbl.	3.90 -......	4.05 -......	4.35 -......
Turpentine, gal.	.45¾-......	.45½-......	.41¼-......
Shellac, orange, fine, bags, lb.	.20 - .25	.20 - .25	.38 - .40
Bleached, bonedry, bags, lb...	.18 - .19	.18 - .19	.28 - .30
T. N. bags, lb.	.09½- .10	.10½- .11	.16 - 17
Soapstone (f.o.b. Vt.), bags, ton	10.00 -12.00	10.00 -12.00	10.00 -12 00
Talc, 200 mesh (f.o.b. Vt.), ton..	8.00 - 8.50	8.00 - 8.50	9.50 -......
300 mesh (f.o.b Ga.), ton.	7.50 -10.00	7.50 -10.00	7.50 -11.00
225 mesh (f.o.b. N. Y.), ton..	13.75 -....	13.75 -.....	13.75 -.....
Wax, Bayberry, bbl., lb.	.16 - .20	.16 - .20	.16 - .20
Beeswax, ref., light, lb.	.20 - .30	.20 - .30	.25 - .27
Candelilla, bags, lb.	.12 -......	.12 -......	.13½- .14
Carnuba, No. 1, bags, lb.	.23 - .24	.26 -......	.32 - .33
Paraffine, crude 105-110 m.p., lb.	.03½- .03¾	.03½- .04½	.03½- .03¾

Price Changes During Month

Advanced	Declined
Nitrate of soda	Ammonia
Mercury	Cream of tartar
Linseed oil	Phosphate of soda
	Rosin
	Cottonseed oil
	Chinawood oil
	Tallow

Ferro-Alloys

	Current Price	Last Month	Last Year
Ferrotitanium, 15-18%, ton.	\$200.00-.....	\$200.00-.....	\$200.00-.....
Ferromanganese, 78-82%, ton.	68.00-.....	68.00-.....	80.00-85.00
Ferrochrome, 65-70%.	.10-.....	.10-.....	.11-.....
Spiegeleisen, 19-21% ton.	25.00-.....	25.00-.....	30.00-.....
Ferrosilicon, 14-17%, ton.	31.00-.....	31.00-.....	31.00-.....
Ferrotungsten, 70-80%, lb.	1.00- 1.10	1.00- 1.10	1.00- 1.10
Ferrovanadium, 30-40%, lb.	3.05- 3.40	3.05- 3.40	3.15- 3.50

Non-Ferrous Metals

	Current Price	Last Month	Last Year
Copper, electrolytic, lb.	\$0.05¼-......	\$0.06¼-......	\$0.07 -......
Aluminum, 96-99%, lb.	.229-......	.229-......	.233-......
Antimony, Chin. and Jap., lb.	.055-......	.05½-......	.065-......
Nickel, 99%, lb.	.35 -......	.35 -......	.35 -......
Monel metal blocks, lb.	.28 -......	.28 -......	.28 -......
Tin, 5-ton lots, Straits, lb.	.236-......	.243-......	.23 -......
Lead, New York, spot. lb.	.0315-......	.0345-......	.0405-......
Zinc, New York, spot, lb.	.037-......	.034-......	.036-......
Silver, commercial, oz.	.27 -......	.28¼-......	.35½-......
Cadmium, lb.	.55 -......	.55 -......	.55 -......
Bismuth, ton lots, lb.	.85 -......	.85 -......	1.50 -......
Cobalt, lb.	2.50 -......	2.50 -......	2.50 -......
Magnesium, ingots, 99%, lb.	.30 -......	.30 -......	.30 -......
Platinum, ref., oz.	33.00 -......	33.00 -......	40.00 -......
Palladium, ref., oz.	18.00 - 19.00	18.00 - 19.00	19.00 - 21.00
Mercury, flask, 75 lb.	49.00 - 50.00	47.00 - 48.00	70.00 - 72.00
Tungsten powder, lb.	1.45 -......	1.45 -......	1.45 -......

Ores and Semi-finished Products

	Current Price	Last Month	Last Year
Bauxite, crushed, wks., ton.	\$6.50 -\$8.25	\$6.50 -\$8.25	\$6.50 -\$8.25
Chrome ore, c. f , post, ton.	16.50 -19.00	16.50 -19.00	19.50 -24.00
Coke, fdry., f.o b. ovens, ton.	3.25 - 3.75	3.25 - 3.75	3.25 - 3.75
Fluorspar, gravel, f.o.b. Il ., ton...	17.25 -20.00	17.25 -20.00	17.25 -20.00
Manganese ore, 50% Mn., c.i.f. Atlantic Ports, unit.	.23 -......	.23 - ...	.25 - .27
Molybdenite, 85% MoS_2 per lb. MoS_2, N. Y., lb.	.45 -......	.45 -......	.45 -......
Monazite, 6% of ThO_2, ton.	60.00 -......	60.00 -......	60.00 -......
Pyrites, Span. fines, c.i.f., unit.	.13 -......	.13 -......	.13 -......
Rutile, 94-96% TiO_2, lb.	.10 - .11	.10 - .11	.10 - .11
Tungsten, scheelite, 60% WO_3 and over, unit.	9.00 -10.50	9.00 -10.50	10.50 -12.00

INDUSTRIAL NOTES

GOSLIN-BIRMINGHAM MFG. Co., Birmingham, Ala., which is a consolidation of the former Birmingham Foundry & Machine Co. and the Joubert & Goslin Foundry Co., has elected Col. George M. Morrow Jr. president.

LINCOLN ELECTRIC Co., Cleveland, Ohio, has appointed Fred C. Archer manager of its sales and service organization in the Philadelphia district.

COOLING AND AIR CONDITIONING CORP., founded by and until recently, partly owned by the B. F. Sturtevant Company, is now a completely owned Sturtevant subsidiary, to be incorporated under the laws of Massachusetts. The name of the corporation will be changed to Sturtevant-Cooling and Air Conditioning Co., with headquarters at Hyde Park, Boston, Mass.

ARTHUR WRIGHT and GEORGE W. O'KEEFFE have formed and organization to be known as Arthur Wright & Associates, equipment and process engineers. Their main office is at 155 East 44th Street, New York City, with a branch office at 1580 Macadam Road, Portland, Oregon. Other offices are to be established throughout the United States and Canada.

ROOTS-CONNERSVILLE-WILBRAHAM, Connersville, Ind., announce that after Nov. 1 their New York office will be located at 24 State Street. D. L. Dowling, district manager, heads the staff in New York.

THE LAMSON Co., Syracuse, N. Y., and the Jervis B. Webb Co., Detroit, Mich., have arranged for distribution of Webb overhead conveyor systems by the Lamson Co.

AJAX ELECTROTHERMIC CORP., Trenton, N. J., has announced that in a cross licensing agreement with the Westinghouse Electric & Mfg. Co., it has arranged to permit the latter concern to manufacture high frequency induction furnaces for certain applications.

F. J. STOKES MACHINE Co., of Philadelphia, Pa., manufacturers of chemical and pharmaceutical machinery, have appointed the J. E. Williams Sales Co., of Cincinnati, Ohio, to act as sales representatives for their line in that territory.

FARREL-BIRMINGHAM COMPANY, INC., Buffalo, N. Y., has announced the appointment of E. J. von der Heide as sales representative to handle Farrel-Sykes gears, gear units and gear generators in the middle west territory.

NEW CONSTRUCTION

Where Plants Are Being Built in Process Industries

	This Month		Year to Date	
	Proposed Work and Bids	Contracts Awarded	Proposed Work and Bids	Contracts Awarded
New England	$25,000	$58,000	$1,680,000	$395,000
Middle Atlantic	481,000	305,000	3,601,000	5,635,000
Southern	47,000	28,000	2,232,000	577,000
Middle West	328,000	275,000	2,051,000	2,468,000
West of Mississippi	388,000	378,000	19,695,000	1,898,000
Far West	268,000	....	4,408,000	931,000
Canada	305,000	400,000	10,200,000	8,085,000
Total	$1,842,000	$1,444,000	$43,867,000	$19,989,000

PROPOSED WORK BIDS ASKED

Ammonia Crystallization Plant—E. I. duPont de Nemours Co., Wilmington, Del., plans to repair plant at Gibbstown, N. J., known as Pepauno plant recently damaged by explosion. Estimated cost about $28,000.

Chemistry Building—Notre Dame University, South Bend, Ind., is having preliminary plans prepared for the construction of a chemistry building. Estimated cost $250,000.

Chemistry Building—Regents of University of California, Berkeley, Calif., having plans prepared by G. W. Kelham, Archt., 315 Montgomery St., San Francisco, Calif., for addition to chemistry building on University Campus, Los Angeles. Estimated cost $150,000.

Chemical Factory—Durolac Chemical Corp., 71 Paris St., Newark, N. J., is having plans prepared for the construction of a 2 story factory at 84 Lister Ave., Newark. Estimated cost $40,000.

Brick Plant—Humboldt Brick & Tile Co., A. W. Busboom, Mgr., Humboldt, Neb., plans to rebuild its brick plant recently destroyed by fire. Project will not mature before next summer. Estimated cost $28,000.

Clay Plant—Union Socialist Soviet Republics, c/o Amtorg Trading Co., 261 5th Ave., New York, N. Y., plans to construct a plant for the manufacture of high grade filter clay in the Republic of Georgia, Russia. Estimated cost to exceed $500,000.

Clay Products Plant—Gladding McBean Co., 660 Market St., San Francisco, Calif., is having plans prepared for tunnel and kiln at its plant at Glendale, Calif., also for vacuum unit at plant at Lincoln, Calif.

Extracting Mill — Canadian Vegetable Oils, Ltd., C. F. Miller, Pres., 37 Imperial Oil Bldg., Vancouver, B. C., plans the construction of a 65 x 145 ft. extracting mill. Estimated cost $25,000.

Filtration Plant—City, Maysville, Ky., will soon receive bids for the construction of a filtration plant to include complete chemical and bacteriological laboratory, etc. Estimated cost $47,000.

Gas Plant—Liquified Natural Gas Co., 1209 Laskay Tower, Minneapolis, Minn., plans to construct a gas plant including storage tank and distribution system to serve city of Tracy. H. H. Henley, 1209 Laskay Tower, is engineer. Estimated cost $35,000.

Gas Plant—New York Central Electric Corp., 89 East Ave., Rochester, N. Y., plans the construction of a gas plant and distribution system at Spring Water, N. Y. Estimated cost $17,000.

Gas Plant—Parsons, Kan., election held to vote on $325,000 bonds for construction of a gas plant.

Glass Factory—Birney-Millville Bottle Works, M. Bateman in charge, Port Norris, N. J., plans converting and modernizing old bottle works at Millville, N. J., into a glass bottle manufacturing plant. Estimated cost $40,000.

Glass Factory—DeVilbiss Co., 300 Phillips Ave., Toledo, O., manufacturer of glass products, plans to rebuild part of its plant recently damaged by fire. Estimated cost $28,000.

Laboratory—Standard Oil Co. of New York, 26 Bway., New York, N. Y., is having plans prepared for laboratory at Paulding Ave. and Boston Rd. D. Wortman, 109 East 29th St., New York, is architect. Estimated cost $28,000.

Leather Factory—Irving Tanning Co., Inc., 38 Irving St., Salem, Mass., plans to construct a 2 story addition to its factory here. Project will mature in 1933.

Linoleum Factory—Paraffine Companies, Inc., 475 Brannan St., San Francisco, Calif., are having plans prepared by L. Rosener, Engr., 233 Sansome St., San Francisco, for an addition to its factory to be used for the manufacture of linoleum. New machinery and equipment will be purchased. Estimated cost $50,000.

Molybdenum Mill—Deertrain Maontor Mines, J. R. Brown, Pres., Northport, Wash., plans the construction of a molybdenum ore handling mill. Estimated cost $28,000.

Paint Factory—Rex Paint Manufacturing Co., 212 Forsythe St., New York, N. Y., will alter and equip building at above address for the manufacture of paint. Estimated cost with equipment $28,000.

Oil Refinery—D. K. Knott, Mayor, Edmonton, Alta., Can., is interested in a corporation being formed to construct an oil refinery, storage and distribution system, at Edmonton. Estimated cost $250,000.

Oil Refinery—Eston Oil Co., Mellfort, Sask., Can., plans the operation of an oil refinery here, initial cost $30,000.

Refinery — Allegany Refiners, Inc., Bolivar, Pa., plans the construction of a refinery here to have a daily capacity of 1,500 bbl. Estimated cost $300,000.

Petroleum Plant—Union Socialist Soviet Republics, c/o Amtorg Trading Co., 261 5th Ave., New York, N. Y., is having surveys made for series of test wells for plant in Slerlitamak oil fields, Urals, Soviet Russia. Project to include pipe line, refineries and power plants.

X-Ray Apparatus—Precision Mechanics Trust, c/o Union Socialist Soviet Republics, c/o Amtorg Trading Corp., 261 5th Ave., New York, N. Y., plans the construction of plant for the manufacture of X-Ray apparatus at Kiev, Soviet Russia. Estimated cost to exceed $1,000,000.

CONTRACTS AWARDED

Alcohol Plant — Rossville Alcohol Co., Lawrenceburg, Ind., awarded contract for the construction of a plant here to Georgensen Construction Co., Hamilton, Ohio. Estimated cost $125,000.

Bakelite Plant—Reynolds Spring Co., Charles G. Munn, Pres., Jackson, Mich., plans to enlarge and equip its plant for the manufacture of bakelite. Work will be done by day labor and separate contracts. Estimated cost to exceed $40,000.

Chemical Factory — General Aniline Works, Inc., Grasselli, N. J., awarded contract for the construction of a 2 story factory to Wilhelms Construction Co., 119 Division St., Elizabeth, N. J. Estimated cost $40,000.

Chemical Plant—Ozark Chemical Co., Cosden Bldg., Tulsa, Okla., plans to construct plant at Soda Lake, Tex., in the vicinity of Monohans, to include sodium sulphate crystallization units. Part of work will be done by day labor, some contracts already awarded. Estimated cost $350,000.

Glass Factory — Owens Illinois Glass Co., Clarion, Pa., awarded contract for additions to its plant here, including warehouse, packing and shipping plant, to Simplex Engineering Co., Washington, Pa. Estimated cost $75,000.

Laboratory — Park-Davis Co., East Jefferson Ave., Detroit, Mich., awarded contract for the construction of an addition and alterations to its laboratory building on East Jefferson Ave., to Butts Construction Co., 6500 Epworth Blvd., Detroit. Estimated cost $30,000.

Leather Factory — Hilliard & Merrill Co., Ridgeway, Pa., awarded contract for the construction of a 1 story, 50 x 160 ft. leather factory to Hyde Murphy Co., Ridgeway, Pa.

Paper Factory—Nekoosa-Edwards Paper Co., Nekoosa, Wis., plans to construct a 2 story, 60 x 120 ft. addition to its plant here. Work will be done by separate contracts. Estimated cost to exceed $30,000.

Cellophane Plant—Sylvania Industrial Corp., 122 East 42nd St., New York, N. Y., awarded contract for addition to its plant at Fredericksburg, Va., to be used for manufacture of "Sylphrap" a transparent cellulose paper, to Hughes-Foulkrod Co., Schaff Bldg., Philadelphia, Pa. Estimated cost to exceed $28,000.

Refinery—Altitude Petroleum Corp., Kennedy Bldg., Tulsa, Okla., plans alterations and repairs to its refinery here. Work will be done by day labor and separate contracts. Estimated cost $28,000.

Refinery—Royalite Oil Co., c/o Imperial Oil Co. Ltd., Calgary, Alta., and 1000 St. Patrick St., Montreal, Que., plans to construct an absorption plant in the Turner Valley Fields, Alberta. Work will be done by day labor and separate contracts. Estimated cost $400,000.

Refinery—Sinclair Refining Co., 45 Nassau St., New York, N. Y., plans to alter its refinery at East Chicago, Ind. Work will be done by day labor. Estimated cost $50,000.

Refinery—Sinclair Refining Co., 45 Nassau St., New York, N. Y., plans improvements and alterations to its refinery at Marcus Hook, Pa. Work will be done by day labor and separate contracts. Estimated cost to exceed $100,000.

Rubber Factory—United States Rubber Co., Maple St., Naugatuck, Conn., awarded contract for 3 story, 40 x 50 ft. rubber factory, to W. J. Magin, Inc., Waterbury, Conn. Estimated cost $28,500.

Varnish Factory—Knox Varnish Co., 80 Freeport St., Dorchester, Mass., awarded contract for varnish factory, to C. C. Temple Co., 2 Park Sq., Boston, Mass. Estimated cost $28,500.

Tallow Rendering Plant—Louis Stern's Sons, Inc., 4th St. and Hackensack River, Kearney, N. J., awarded contract for 1 story tallow rendering plant to James Mitchell, Inc., 575 West Side Ave., Jersey City. Estimated cost $40,000.

Paint Warehouse—McCann Shields Paint Co., Alexander St., W. E., Pittsburgh, Pa., awarded contract for 3 story, 35 x 60 ft. warehouse, to Henry Busse Co., 112 Wabash Ave., Pittsburgh, Pa.